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SCENERY, SCIENCE AND ART;

BEING

EXTRACTS FROM THE

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NOTE-BOOK OF A GEOLOGIST AND MINING ENGINEER.

AA.b.11.

BY

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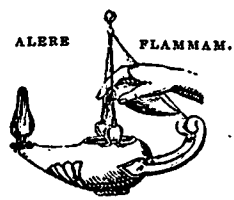


PREFATORY NOTICE.

The following pages really are what they purport to be, extracts from the note-book of a geologist much engaged in various economic inquiries which are connected with and arise out of scientific investigations. In the course of his inquiries, the Author has often noted down in greater or less detail those events and facts that seemed to him at the time important, whether bearing directly on his immediate object, or affecting the practice of geology in other departments, or worthy of remark from their novelty or general interest. It has sometimes happened that accidental delays in travelling have enabled him to write down his impressions at once, and at some length; while not unfrequently points of the greatest

interest have been very slightly touched upon, simply from want of time to record observations.

The mixed tone of scientific discussion and narrative that prevails in this book may seem tedious to some readers; while others may be willing to excuse, if they do not actually approve of it. It must be left for the critic and the public to determine whether the matter will justify the manner.

Most of the actual statements made can be depended on, as they are either the result of personal investigation or strict local inquiry. For the opinions and conclusions the author alone is responsible; and, with regard to these, he is anxious to have it understood that he is wedded to no theories, and is only desirous of bringing out the truth.

17 Manchester Street,
London, 31st July, 1854.

LIST OF ILLUSTRATIONS.

LITHOTINTS.

PLATE 1. A street in Madrid.....Frontispiece.
2. View of the Pic du Midi de Pau .....To face page 42
3. The Silk Hall of Valencia ..... „ „ 112
4. The Harbour of San Sebastian ..... „ „ 136

WOODCUTS.

Page

FIGURE 1. Section across the coal-field of Ancenis (Brittany) ... 7
2. Section across the thick coal and lower seams in the Aubin coal-field (Aveyron)..... 14
3. Section across the middle seams of the Aubin coal-field (Aveyron) 15
4. Section across part of the Mondaluzac iron-field (Aveyron) 19
5. Square arch in the Gallery of the Knights at Nîsmes, formed of solid blocks of stone 34
6. View of the Pont du Gard, near Nîsmes 36
7. View of the town and château of Pau..... 41
8. Costumes of fisherwomen, St. Jean de Luz, near Bayonne, on the Spanish frontier..... 138
9. Group of ancient Roman vases, from the Western coast of the island of Sardinia 167
10. Plan of a house at Gonnos Fanadiga, a village in the island of Sardinia 175
11. Group of Sardinian villagers in their national costume 176
12. Ancient monoliths in the island of Sardinia 178

Page

FIGURE 13. A Nur-hag, or ancient round-tower, in the island of Sardinia 179

14. Side view and intaglio of a curious *scarabæus* of green jasper, from the island of Sardinia 180

15. Group of ancient Roman vases, from the island of Sardinia ..... *ib.*

15 *bis*. Costume of the Arabs of Algiers 193

16. Ground plan of a mosque at Algiers 197

17. Fac-simile of an Arabic pass from Cherchel to Tenez.. 240

18. Section of Kanawha coal (Western Virginia) across one of the lateral valleys 264

19. Illustration of the temporary dying out of a coal seam in the Kanawha coal-field 274

20. General section across the Appalachian chain, from the valley of the Ohio to the Atlantic..... 282

21. Section across the district worked for gold in the Garnett and Mosely mines, in Eastern Virginia ... 289

CONTENTS.

FRANCE.

Page

I. Account of a Coal-field near Nantes.—Scenery on the Banks of the river Erdre, in Brittany 3

II. Mineral Fields and Limestone Plateau of the Department of Aveyron (Central France) 10

III. The Plains of Languedoc and Gascony,—their Towns, Antiquities and Inhabitants 31

SWITZERLAND.

I. Walk from Lausanne through the Jura Valleys 47

II. Meeting of the French Geological Society at Porrentruy in 1838 58

GERMANY.

Pyrmont, and the German Naturalists' Meeting 73

SPAIN.

I. The Pyrenees and the Valley of the Ebro..... 83

II. Tarragona and Valencia—the Country and Towns on the East Coast 103

III. Madrid and its Museums of Science and Art 117

IV. The Central Plateau and Natural Passes of Spain. A Visit to Granada and the Alhambra 132

V. The Valley of the Alpujarras—the last Resort of the Moors in Europe 145

ISLAND OF SARDINIA.

Page
I. The Coast, the Country, the Towns, and the People 167
II. The Mines and Mineral Resources 181

AFRICA.

I. The Towns and People in the Province of Algiers 193
II. The Physical Geography, Geology, and Mineral Resources of the Province 212

AMERICA.

I. New York and Pittsburg 243
II. The Ohio and Kanawha Valleys, and the Coal Basin of the Kanawha (Western Virginia) 255
III. The Alleghanies and the Gold District of Eastern Virginia 277
IV. Slavery as an Economical Question 294

ERRATA.

Pages 200, 201, and 202, in various places, *for* Cherchell *read* Cherchel.

FRANCE.

I. COAL-FIELD NEAR NANTES AND SCENERY OF THE BANKS OF THE ERDRE.

II. MINERAL FIELDS AND LIMESTONE PLATEAU OF AVEYRON.

III. THE PLAINS OF LANGUEDOC AND GASCONY,—THEIR TOWNS, ANTIQUITIES AND INHABITANTS.

SCENERY, SCIENCE AND ART.

FRANCE.

CHAPTER THE FIRST.

ACCOUNT OF A COAL-FIELD NEAR NANTES.—SCENERY ON THE BANKS OF THE RIVER ERDRE IN BRITTANY.

I HAVE lately been examining a small and singular coal-field extending from a few miles north of Nantes eastwards to the Loire at Chalonne, and in the course of my exploration had occasion to descend from the little town of Nort by an old rickety packet-boat of some twenty horse-power to the Loire at Nantes, following the course of the river Erdre, which is chiefly known as being a part of the line of water communication between Brest and Nantes. I was so much surprised and delighted at the singular beauty of this river during the greater part of its course, that I am anxious to communicate to others a means of enjoying charming scenery in a retired corner of France, which still retains a large number of its primitive habits and costumes.

The coal-field of this part of Brittany is not very important. It consists of a singular belt of carboniferous rocks ranging nearly east and west, and reaching from the terminus of the Brest and Nantes Canal, where it enters the Erdre a few miles north of Nantes, to Chalonne, not far from Angers on the Loire, a total distance of about sixty-five miles. This belt contains two groups of coal-beds, both which are nearly vertical, but they have a uniform south dip as far as is known in the con-

cession I visited, where the total number of beds is thirteen, of which however only four can be regarded as distinctly determined and available for working. They are all very irregular, varying from a few inches to 12 or 15 yards in thickness, but the average thickness may be taken at from 3 to 5 feet. The two groups are about 150 fathoms apart, and the pits hitherto sunk have been almost all on the beds to the south. The associated rocks are chiefly gritstones, more or less coarsely grained, and often stained with iron and coal. Shales occur near the coal-seams, and the presence of coal is often indicated by wet hollows. One such hollow ranges east and west, parallel with the strike of the coal and between the north and south groups. There is probably here a thick mass of shale, and possibly an east and west fault, but the fault is not proved.

The coal in this district has been partially worked for many years, and a large quantity has been got from numerous shallow pits opened on the crop of some one of the seams, and following the coal down till the pit has fallen in. It is supposed that scarcely any shafts have been sunk more than about 100 fathoms. A pair of new vertical pits has been put down in a convenient spot near a good road by the present manager, and one pit has cut the coal at ten fathoms. The coal appears to be of inferior quality, but is in demand for lime-burning in the vicinity. Numerous crops of this and other beds are easily shown by opening costeaning pits in the fields, or examining the roadside cuttings. The cost of sinking a shaft (measuring 10 feet by 7, and divided by a brattice) is not more than £4 a fathom for shallow depths, but a deep pit (say 100 fathoms) would probably average £24 per fathom, including timbering. As much as fifteen fathoms per month could be sunk in the kind of rock hitherto met with in the district.

The qualities of the coal in the northern and southern beds are somewhat different; the former being sold as a smith's coal and the latter for kiln work. Each appears sufficient for the purposes to which it is applied. In appearance the coals are dirty, tender, very flaky, not very bituminous, and rather sulphury. They burn, however, with tolerable readiness and with some little flame, and do not leave a large quantity of ash.

The principal demand for this coal has hitherto arisen from numerous lime-kilns in the neighbourhood constructed on a

large scale. These are said to require at least 20,000 tons a year, and no doubt a market exists for an additional quantity, taken for the use of Nantes and various towns in Brittany accessible by water carriage. It is however difficult, if not impossible, to decide whether a very greatly increased supply would be met by a corresponding demand, although it certainly appears that the supply is insufficient. The coal is not much, if at all, used for domestic purposes. The present sources of supply are the mines worked on concessions at Chalonne on the Loire towards the east and at Langhien towards the west. The capital invested has hitherto been too small to admit of any successful competition with operations conducted with due economy and on a large scale, should any such be undertaken.

The high-roads in the district are excellent, but the cross-roads utterly impassable in bad weather, and bad even in summer.

The price of English coal at Nantes and Ancenis is as much as 24*s*. per ton (May 1853). The coal of the district is not very well adapted to the manufacture of gas, and its use must be chiefly confined to railway and steam-boat purposes, if found to be an available fuel. It could probably be sold at Nantes at a low price, provided a market could be found.

No large amount of capital and no operations on an extensive scale are either desirable or likely to bring out a successful result in the case of this property. If in careful hands and with a sufficient capital to try the experiment fairly, and provided there turns out to be a real opening for a large consumption at Nantes and Brest for steam purposes, very handsome profits might be securely realized on a small outlay, but until the coal has been tried and has proved to answer the purpose, it would be unsafe to promise any important result. If put into hands unaccustomed to the country and people, it must prove a failure, and a great increase of supply, without first ensuring a market, would probably involve a heavy loss.

The beds of coal seem to occur between a band of fine pure limestone coming out to the south, and old shales and slaty rocks to the north. The limestone forms hills, and is extensively worked for burning. Sixty or seventy huge cones for burning the lime, each provided with winding roads running up its sides, or with great bridge-like approaches from the hill-side,

form a curious feature in the landscape. These are in groups of three, four, or half a dozen, and are picturesquely placed enough, the limestone being harder than the adjacent rocks. The kilns are placed near the limestone to avoid the expense of carriage, and the owners of these kilns live on the spot and look after their property.

It is a pretty sight to stand on one of the bridges between two huge kilns and look at the yawning chasm, partly formed by nature, but greatly enlarged by man, on both sides of which are numerous groups of quarrymen actively boring, blasting, and removing the massive limestone, carting it into little wagons, and bringing it up the inclined planes to feed the insatiable mouths that stand ever open for the reception of fresh supplies. Here and there a jagged odd-shaped rock projects from the earth, and may be seen to be a cherty or flinty portion of the rock left behind by the water when eating out a passage between the limestone on the two sides. At a distance one sees curious banded portions, and on approaching nearer a large number of white crystalline streaks, which the practised eye of the geologist at once recognises as connected with fossils, the remains of the inhabitants of the ocean, when these hard rocks were mere soft plastic mud, itself derived for the most part from animal structures.

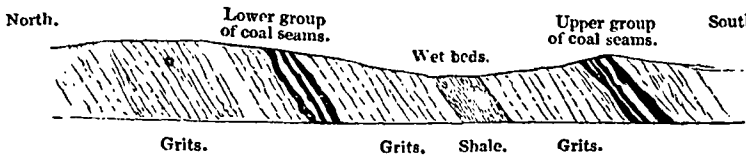
The ground between the Loire and the northern limits of the little coal basin consists of low undulations, ranging nearly east and west. The coal itself is worked on two of these, between which is a swampy bit hardly deserving the name of a valley. A good many high chimneys belonging to little steam-engines now neglected, dispute the title of the scenery to that essentially rural character which it would otherwise undoubtedly possess. These, with numerous small windmills and a perfect forest of fruit-trees, which at the time of my visit (on the 2nd May) were all white with flower, give great beauty to the landscape, which is indeed quite deserving of notice as an admirable specimen of Loire scenery. In this part of the country hedges exist everywhere, and are exquisitely fresh and green—not too straggling, at least in spring, and breaking the usual monotony of the fields of France. The land is highly cultivated, looking for the most part like a garden; and as I had left behind in England, and even on the Rhine whence I had just come, a climate as severe

as winter and much less pleasant, the sudden transition to the warm breath of spring was not the least delightful part of the trip.

My business in this part of the country detained me but one day, examining old coal-pits and new ditches and roads, to see how far it might be desirable to bring capital to bear on the supply of mineral fuel which nature has here provided. The supply is not only small in comparison with coal deposits found elsewhere, but it is also highly irregular. The beds, sometimes only a few inches thick, occasionally swell out to a dozen yards, and it would not be easy for a person unaccustomed to examine coal to recognise in the flaky shining powder brought up, or the earthy stain seen at the surface, any valuable indications worth following. There is, however, no doubt a good deal of mineral fuel, and of a quality quite worth having, particularly when we consider the price of English coal (the only kind available) at the nearest points.

The annexed cut (fig. 1) will give an idea of the position of the coal in this district, and the way in which the shales and impermeable soft beds are indicated by the wet hollows on the surface. The two principal groups of coal-seams inclined at a considerable angle are also shown.

Fig. 1.—*Section across the coal-field of Ancenis.*



From the coal-field we drove to the little town of Nort, very prettily placed, with several windmills on a small hill by its side, on the banks of a stream very little known, but well worthy of a visit from the true lover of the picturesque. Just as we reached the bridge which here spans the river with three small arches, the steam-boat, which daily travels between this place and Nantes during most part of the year, was not only starting but had actually got under way, but at a sign made by one of my companions and a great shouting from everybody near, the captain was polite enough to put back and enable me and my two companions to come on board. We found plenty of room, and

indeed the vessel claimed to be possessed of a license to carry 250 passengers, a notification of which was proudly placed on the paddle-boxes, but I doubt whether the odd fifty would have found such accommodation as a seat in any part of the vessel. However that may be, there was abundant room for our party, and we were soon paddling away towards our destination. At first and for some miles the scenery was pretty but by no means striking, there being a large sheet of shallow water with low hills rising in the distance, and small villages or large houses dotted about on the banks. After about a third of the way had been accomplished the river banks closed in, rocks began to show themselves on each side, the shores assumed a different and bolder character, and we entered on a succession of the most charming groups of picturesque objects, consisting of rocks, trees, houses, châteaux, little chapels, round towers, and ruined sheds, that can be imagined. The river here winds a good deal, and the character of the scenery is in all respects that of enclosed water, so that for a distance of at least twelve miles we seem to pass through a noble and beautiful lake, its shores covered occasionally with low wood, but more frequently cultivated like a garden. There were pleasant country houses of all dimensions and all varieties of taste on both sides; with villages not less picturesque than those on the Moselle, placed just where they ought to be—well seen and well sheltered; and at intervals there were breaks into the country beyond, heightening the effect without altering the character of the scenery.

I am tolerably well acquainted with river scenery, and am by no means one of those who have but a single standard of comparison, referring everything to the Rhine—a reference more common than it is reasonable. I was certainly not prepared for this little treat, and it thus came upon me by surprise; but I do not think I exaggerate when I say that it is better worth seeing and studying for its effects than half the river and lake beauties that people travel far to look at, and I would strongly recommend every one who is near Nantes to make a little effort in order to judge for himself how far my picture is true. I admit that the weather was pleasant, the time of year favourable, the sky as well as the earth gay, and that during the whole time of our descent through the best part of the river, the clouds produced a succession of fine effects of light and shade, and a

rainbow never ceased to lend its help to throw a charm over everything. Still the scenery itself is unmistakeable.

There is no change except in the natural variety and succession of views, until the huge mass of building that towers over Nantes comes into view; but from this point the bustle and life of a great town begin to alter the style of the scenery. Here too we begin to see on both sides the peculiar and always picturesque Breton costumes—the women with their high head-dresses, and the men in their old-fashioned coats and waistcoats; and soon the streets of the town come into view, and we are landed a few yards from a bridge over a little stream, which passes along a street (and not a very wide one) for a short distance and opens into the Loire. One is not a little astonished to find that this poor stream, which looks marvellously like a ditch, and is at best but a narrow canal, is all that remains of the Erdre whose beauty we have been admiring. In point of fact the waters of the little river are kept back, and made to serve the purpose of a reservoir connected with a canal. Above Nort and below the first lock at Nantes it is nothing; between these points it is a noble and beautiful sheet of water, rich in all that can please the eye and gratify the taste of the traveller who has a love of the picturesque.

CHAPTER THE SECOND.

THE MINERAL BASINS AND LIMESTONE PLATEAU OF THE DEPARTMENT OF AVEYRON IN CENTRAL FRANCE.

Comparatively few travellers, whether in search of the picturesque or influenced by other reasons, follow the road from Clermont by the Cantal and Aurillac, and so across the department of the Aveyron towards Montauban and Toulouse. Fewer still, unless impelled by special reasons, would think of stopping short at the towns of Figeac or Villefranche, diverging into the valleys of the Lot and its tributaries, and visiting the iron-works, coal-mines, or mineral springs of Decazeville, Aubin, or Cransac. Very few also of the thousands and tens of thousands who traverse France to reach the Mediterranean, are at all aware that they are leaving on one side, at no great distance, some of the most remarkable deposits of coal, ironstone and limestone, and some of the most interesting groups of metalliferous veins that exist in any part of Europe.

Such, however, is undoubtedly the case. Aveyron contains as a department an amount of mineral wealth almost inconceivable in its magnitude, and the valuable minerals exist under circumstances extremely favourable for development, so soon as the iron way shall have been constructed to open a road for their conveyance, and enable them to be distributed over the country in every direction at small cost. The Great Central railway of France now in course of construction will answer this great purpose, so that within a few years the first results may be anticipated, and France may commence to lay open her stores of coal and iron, and perhaps of lead and copper, and thus come into competition on no unfavourable terms with Belgium, and even England, in respect of these important elements of advance in wealth and civilization.

It has long been known that several small deposits of coal, generally of rather poor quality, exist, and are worked in various parts of the South of France. The position of these coal-fields and the quality of the coal are for the most part such that they

have hitherto possessed little value, hardly competing with the produce of foreign mines at the different ports, even those nearest the place where the coal is worked, and in spite of heavy protective duties. In most cases the coal has not been worked without great expense, and has not admitted of either rapid or complete abstraction. Beds and veins of iron ore, although numerous, and in some cases very extensive, rich, and of great thickness, have not been found near enough to the coal-fields to allow of profitable working without high protective duties, almost excluding the possibility of foreign competition on a large scale. The general result has been an unreasonably high price of iron, and a corresponding difficulty in applying the metal in numerous cases where its use was otherwise desirable.

The bringing into operation a very extensive and valuable coal-field, with large supplies of good iron ore of various qualities within a moderate distance, was of itself a very important step, and would have justified great efforts. The construction of a line of railway connecting this district with the chief manufacturing towns and ports in the South of France, both on the Atlantic and Mediterranean seaboard, was the way to ensure the most complete success on the largest possible scale.

The large operations recently commenced in reference to the coal-field of Aubin, and the iron ores of Mondaluzac and its neighbourhood, and the laying open of these districts by the Great Central railway, will in a few years create new and gigantic interests in this part of the department of Aveyron, and it may be interesting to give some account of a district destined in all probability to be the centre of profitable mining and of metallurgical processes far more extensive than are at present carried on in France.

§ 1. COAL AND IRON.

The position of the coal-fields of France in the southern departments is extremely curious. They form a very numerous group, and are often really detached, being distributed on and around the wide sea of crystalline rock, of which the granite and extinct volcanos of Clermont, Cantal, and the Puy de Dome are the centres, and from which spring the Loire and its numerous tributary streams, and the Dordogne and other main feeders of

the Garonne. The Rhone from Lyons and the Saône from Chalons completely cut off this tract by an almost straight line; but neither of these rivers takes away any of its drainage, except a portion removed by small streams rising only a few miles from their embouchure. The district is thus geographically isolated, and belongs in drainage to the Atlantic system, the courses of the Saône and Rhone marking the direction, and almost the actual line of watershed.

The number of coal-fields, or places where coal can be worked, within and immediately around this area is extremely great, and is probably not yet fully known. It includes the basins of St. Etienne, of Alais and St. Germain, of St. Gervais and another near Beziers, several around Rodez, Aubin and Decazeville, Autun, Blanzy and Creuzot, and Brassac, besides many others. Although widely separated, there can be little doubt that these really belong to one group, deposited under circumstances not very dissimilar, and for the most part on irregular floors of granite and gneissic boulders, being associated and interstratified with conglomerates of the coarsest kind.

Of all these coal-fields, the one that appears most likely to admit of rapid development, and profitable working on a large scale, is that of Aubin, partly from the condition, position and quality of the coal, and partly from the fact, that immediately around, within a circle of twenty miles, there are found stores of iron ore, practically inexhaustible, and obtainable at the smallest possible cost.

The commencement of the Aubin basin (which ranges south and south-east, gradually widening in that direction) is about twenty-five English miles south of Aurillac, at a point where secondary rocks, chiefly calcareous, project across from the east, covering the gneiss to a great thickness, and meet a corresponding spur of oolite from the west. It is thus not only isolated in the crystalline rock, as is the case with most of the other basins named, but is almost surrounded and greatly covered up by deposits of the secondary period, which contain the valuable supplies of ironstone rendering the district so important.

Running southwards from Aubin, parallel to the escarpment of the oolites, and at no great distance, is a ridge of granite, at whose contact with the stratified rocks are numerous metalliferous veins of great promise; and as this is crossed by the valley of

the Aveyron, a river of some importance, the country is remarkably favourable for mining purposes.

The Aubin coal basin is chiefly worked at the southern extremity of the bell-shaped area which it occupies, and is there covered up by jurassic rocks. The coal seams repose on and are associated with pale shales, grey grits, and conglomerates composed of large and very unequal blocks of rolled rock, and seem to occupy an irregular trough. The boulders include masses of granite more than a cubic yard in contents, and innumerable blocks of smaller size. The dip of the beds is extremely variable near the edge of the basin, commencing at an angle of 70°, where thin beds of coal are seen with sandstones. The pitch gradually diminishes as we pass into the basin, and alters in direction, showing considerable local movements.

The valley in which the town of Aubin is built is small and narrow. It traverses the coal basin, and is drained by a small tributary of the Lot. There are already extensive iron-works and some other manufactories in various parts of the valley and adjacent country, and more must shortly rise.

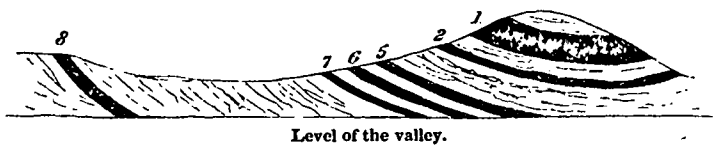
The coal-seams now worked near Aubin crop out on the sides of the hill facing the south. On the opposite side of the valley is a good section of the lower beds underlying the coal, which include some building-stones and a fire-clay of tolerable quality. Towards the upper end of the valley at Cransac is a village and some mineral springs of considerable importance. These latter are not at present very accessible, as the roads are only recently constructed and the accommodation is very poor.

The dimensions of the portion of the basin exposed, and in which the coal crops out at the surface, are about twelve miles in extreme length, with a breadth varying from one to five miles. The Aubin concession alone includes 1800 acres or thereabouts, and that of Decazeville is not less extensive.

There are eight or ten distinct seams of workable thickness cropping out in the Aubin valley, on the hill-side facing the south, and all these contain coal sufficiently good to justify extensive operations. The average total thickness of the beds is not less than 124 yards, as measured on the crop, and all this extent can be reached without sinkings. The roof of the different seams is generally a grit of tolerable hardness, and standing well without timbering. The floor is also generally of the same

nature. Over the roof is a large quantity of pyritous shale, which occasionally burns spontaneously for a long time, producing a singular appearance, not unlike that which may be seen sometimes near Newcastle, where the slack or small coal is left in heaps at the pit-mouth.

Fig. 2.—*Section across the thick coal and lower seams in the Aubin coal-field.*



Some of the seams worked in this basin are of very unusual thickness, but all appear subject to great and sudden variations. In one mine (les Etuves) the coal is as much as fifty yards thick where worked, and as the whole of this is near the surface (see 1, fig. 2) and above the level of the valley, it is found possible to pare away the surface and remove the coal by a process analogous to quarrying. The actual quantity of available coal in this seam in the Aubin concession cannot be less than 10,000,000 of tons, all above the valley; and the same bed, though disconnected, is repeated at intervals, and is worked in the Decazeville valley.

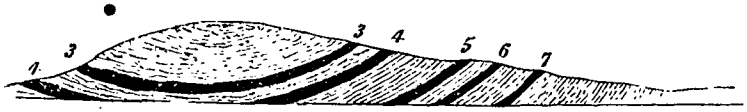
Two other seams (Fournal (3) and Bois Nègre (4), fig. 3) measure together no less than thirty-eight yards in thickness, and there are others from two to ten yards each where worked. The beds less than four or five feet thick are not even named. It must, however, be borne in mind that the thickness is not the same over any length of section, although the seams themselves appear constant *.

* The following are the names and average thicknesses of the different seams whose relative position may be judged of by the sections (figs. 2 & 3) in the text:—

	Yds.	Ft.
No. 1. Les Etuves (Pelonie haute)	50	0
2. Pelonie basse	4	0
3. Fournal	16	1
4. Bois Nègre	21	2
5. Fraysse No. 3 (Montet No. 1) (Bussonie No. 1)	7	2
6. Do. No. 2 (Do. No. 2) (Do. No. 2)	5	1
7. Do. No. 1 (Do. No. 3)	8	2
8. Passelaygue (Bezelgues)	10	2
	124	1

The quality of the coal is variable, but generally sufficiently good for manufacturing and household purposes. The thick coal (les Etuves) burns with a long flame, and is valuable for domestic use; the twenty-yard seam cokes well, and would be valuable for locomotives, and for the manufacture of iron; some parts of it also yield a fair per-centage of gas. The Passelaygue (ten yards thick) is greatly valued as an excellent coal for the forge. It is clean and moderately hard, but is interstratified with a small band of shale and pyrites, making it desirable to wash the coal before coking.

Fig. 3.—*Section acros the middle seams of the Aubin coal-field.*



The various seams have been hitherto worked on a system which may be described as a convenient combination of the pillar and stall with the long-wall method, a small proportion of coal only being left behind, and very little timber used. The cost of extraction is very moderate, and it is distinctly proved that any quantity of mineral can be brought to bank at a cost varying from a shilling to twenty pence per ton of twenty hundredweight.

A few bands of iron ore certainly occur in these coal-measures, but none have yet been worked, and it is very possible that when attention is drawn to this subject, other and thicker layers may be found.

The south-eastern portion of the Aubin coal-field is covered up with beds of the triassic period, which are soon succeeded by soft red sandstones and oolitic limestones. Near Marçillac, the sandstones contain marls in which a considerable amount of copper has been found, chiefly in the form of a small gravel of malachite pebbles. The coal reappears in this direction on the edge of the crystalline rocks in one or two places before reaching Rodez. At this point several pits have been sunk and mines opened.

The Rodez basin (somewhat improperly so-called) consists of a series of beds of coal dipping heavily to the north, reposing on the schists and gneiss or granite of the Aveyron district on

the south, and covered up almost immediately, first by new red sandstone rocks of no great thickness, and then by hard calcareous beds of the liassic period. An extensive and important series of oolitic limestones next succeeds, and ranges for a great distance.

The ground where the coal crops out consists of a series of hills of some elevation flanking the crystalline rocks, and occupying part of the narrow space between them and the river Aveyron. The length of the crop is about six miles from Rodez to Laissac, but the coal reappears near Severac, a distance of about fifteen miles from Rodez, and is supposed to be continuous throughout. I saw no distinct proof of this, although it is by no means unlikely, and indeed there is little doubt that beneath the secondary rocks the coal-measures will ultimately be traced at intermediate points round the whole of the eastern side of the granite and gneiss of Aveyron from Aubin by Rodez, Severac and St. Afrique to St. Gervais, Graissesac, and the other coal-fields already known in the south.

The breadth of the Rodez coal-field as determined by the outcrop of beds of the carboniferous period is extremely limited. Of the coal-seams there are four described, but only two or at most three appear worth working. These vary in thickness from three to as much as eighteen feet each, but cannot, I think, be calculated on as having in all a greater mean total thickness than twelve feet. The middle part of the crop appears to have the thickest beds, but these do not extend many hundred yards without becoming nipped to about a third of their dimensions. The total distance between the crystalline rocks and the new red sandstone does not much exceed half a mile, and hitherto there has been nothing absolutely proved beyond that limit. The beds incline at angles varying from 30° to 60°, and the principal bands of coal are within a thickness of 100 yards of measures. The lines of outcrop, though really continuous, are difficult to trace, and the actual relation they bear to each other is imperfectly made out over most part of the field.

I considered it important to obtain an estimate, however general, of the total quantity of available coal in these concessions, and I therefore made the necessary calculations for the purpose. Owing to the great irregularity in thickness of the different coal-seams, and the very considerable slope of the beds, the

result is small compared with other concessions of anything like equal extent. I cannot anticipate a larger quantity than sixteen millions of tons as the available produce of the district I visited for all the seams, if worked to a depth of 150 fathoms below the water level. It will be understood that the absolute exhaustion of the field to this extent could not take place without a number of deep pits, each provided with all requisite machinery for extraction, and must take considerable time. From any single pit in this district some time must elapse before a quantity of coal amounting to 100 tons per day could be properly taken, as the whole of the preliminary works are yet to be commenced.

The first aspect of the Rodez coal is unfavourable, as it has a stony, dirty appearance and bad colour; but on further examination and actual trial, it proves to be much better than could be supposed. It burns freely with a moderately long flame and much heat. It does not die out rapidly, or consume quickly; and though the proportion of ash is not small, it is by no means excessive. It cokes well, and in large, compact and clean-looking pieces, and the coke, made after washing the coal, would certainly be well adapted to the manufacture of iron. The proportion of coke is about sixty-six per cent. of the washed coal. The present average cost of getting the coal and bringing to bank is considered to be nearly 3*s*. per ton. The cost of the coke properly made from washed coal would not be less than 7*s*. per ton.

The concessions brought under my notice include almost the whole of the field from Rodez to Laissac, a distance of between five and six miles. In most places the coal has been got by shallow pits, and foot-rails or small levels run in upon the coal at its crop. As much as could be carried off thus without timbering, shafts, or cross-cuts, has been already removed, and the result has been to some extent injurious to the upper part of the remaining coal. A large quantity of coal might, however, still be obtained by deeper adits entering in some places from the valley of the Aveyron, although no extensive mining operations could be carried on without arrangements being made for deep sinkings, in which it is not unlikely that there would be a large quantity of water *.

* Since my visit I learn that the coal has been lately reached by a shaft sunk through a moderate thickness of the new red sandstone, and that it is

The principal employment of the Rodez coal has hitherto been for local purposes, such as lime-burning, and for domestic use in the neighbourhood, and the average annual supply from the Bennac mine, the only one at present in work, is about 4500 tons. The greatest amount that has been taken from this mine in a day is sixty tons, nor does the system of working admit of greater development.

The profit has been large in proportion to the amount of sales, being in fact almost equal to the expenses. There is, however, little capital invested, and the cost of management is extremely small. It must be borne in mind that no opportunity exists for greatly increased development, as the demand is nearly, if not quite, supplied, and the market would hardly admit of any addition to the quantity without a reduction of price, nor even then to any great extent, unless the means of communication are improved.

The one great resource for this, as for all the adjoining coal basins, is the establishment of railway communication with the principal towns of the South of France. It is proposed to bring a branch of the Great Central Railway (the main line of which is now in course of construction) to the town of Rodez, and in this case all the coal property would become very valuable, as iron ores are abundant at no great distance.

The chief sources of iron ore to supply the Aubin and Decazeville furnaces, and others in these coal districts, consist of thick and widely extended deposits in the limestone rocks immediately adjacent, belonging to the oolitic period. There are also large quantities of other kinds of ore, valuable for mixing, brought from various places within a radius of twenty or twenty-five miles. Amongst these is a rich and valuable hydrous oxide from Perigord, and some other very rich peroxides combined with silica, from Lunel.

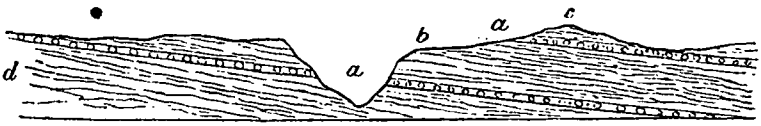
The jurassic rocks on both sides of the Aubin coal-field are remarkably rich in ferruginous deposits in the limestone. At Veuzac, near Villefranche, are two beds, each a yard thick, nearly horizontal, and close to the surface. The cost of getting is less than fifteen-pence per ton. The ore is partly pisolitic, and the beds are traceable on the surface for five or six miles.

much more horizontal and of better quality there than in the mines of Bennac, the nearest point at which it crops. This discovery greatly increases the value and importance of the mineral field.

The principal source of supply of calcareous iron ores is near the villages of Mondaluzac and Cadayrac, a distance of about twenty miles from the iron works at Aubin, but admitting of easy communication, as the deposit is situated on a somewhat lofty plateau, having an easy and almost continual descent of several miles to the valley. A railway was in course of construction at the time of my visit, which would convey the ores to the coal.

The following section will give an idea of the position of these ferruginous bands in the jurassic limestone.

Fig. 4.—*Section across part of the Mondaluzac iron-field.*



a, *a*, two beds of ironstone; *b*, *c*, *d*, the limestone bands.

The oolitic plateau consists of bands of hard limestone, covered in some places by (in others alternating with) thick beds of highly ferruginous limestone, passing into pisolitic iron ore. Two distinct beds are recognized, one of which is worked, but others probably exist. The one in work contains from five to six feet of a dark purple ore of good quality, consisting of a mixed oxide and carbonate of iron with carbonate of lime, the yield averaging about twenty to twenty-two and a half per cent. Occasional bands of pyrites occur, but may easily be avoided, and some rich ochraceous portions may be noticed. In the state in which I saw it, this bed would give at least ten thousand tons of ore (equivalent to two thousand tons of iron) to the acre, and many square leagues of country are available. The other band is at least equally thick, and the quality appears to be quite as good.

The only objection to the use of these ores at Aubin and Decazeville is the cost of transport, which at present amounts to 6*s*. 8*d*. per ton. The railway, when completed, will reduce this cost to twenty-pence.

§ 2. COPPER, LEAD, AND OTHER METALS.

There are in France five metalliferous districts, none of which are at present in very active work. The most extensive of them

is that of the central plateau of France, including Auvergne, Limousin, Les Cevennes, and a number of other known localities. It occupies a vast space, but is not now the scene of mining operations, except in a few places where argentiferous galena and some copper ores are obtained, the former being the principal mineral. The southernmost extremity of this great plateau is situated in the department of Aveyron, and is partly covered by the coal-measures, new red sandstone and jurassic limestones just described, but it includes also several groups of metalliferous veins, formerly much worked, although of late nearly neglected. Till within a few years these veins were almost unapproachable, owing to the total absence of roads, except between the principal towns. Excellent cross-roads now traverse the country in every direction, and the Great Central railway, in course of construction, will lay it open completely by numerous branches and connect it by way of Montauban with the Bordeaux and Cette railways and the whole of the South of France, and also by other branches with Lyons and thence eastwards to Italy, and by Clermont with Paris.

Regarding Aubin as a central point, there are three metalliferous tracts around it capable of yielding ores of lead and copper. One extends about fifty miles towards the south-west to the towns of Najac and Pichiguet, along the western contact of secondary deposits with the crystalline rocks and schists of Aveyron. Another extends for about twenty miles towards the north-west to Figeac. The third extends nearly seventy miles towards the south-east to Milhau and St. Afrique, along the eastern contact of similar rocks. The chief towns of the district are Villefranche, Rodez, St. Afrique, Milhau, Najac and Figeac, but there are numerous villages and smaller towns. Three principal rivers, the Aveyron, the Lot and the Tarn, with several of their tributaries (the Alzou, Seréne and Viaur being the most important), traverse the whole department of Aveyron, and some one of them is available both for water power and washing or dressing ores at every place where mining operations would be desirable. The district consists of elevated plateaux intersected by deep ravines, and the metalliferous veins are for the most part capable of being worked from adit levels run in from the bottom of steep ground near a stream.

It has already been mentioned that a granitic axis extends

parallel to and near the Aveyron valley ranging southwards from the town of Villefranche. The first and second of the above tracts of country may be regarded as parts of the same range, and are singularly rich in mineral veins, often of large dimensions, some containing marked indications of argentiferous galena, others certainly rich for copper near the surface. This latter metal appears to have been obtained formerly in large quantities.

The condition of the minerals obtained from some of the mines of this group suggested to me the desirability of testing it for gold by Berdan's machine, and I lately obtained from about ninety pounds of a mixed copper and lead ore from Pichiguet a result exceedingly striking, the yield being,—lead, 25 per cent.; copper, 18 per cent.; silver, 27 oz. to the ton of ore, and gold 4 oz. 14 dwts. also to the ton of ore.

The lodes in this part of the mineral field range chiefly north-west and south-east, or within a few points of those bearings, but there are important north and south veins containing much ore. In a number of places there is every indication of lodes having been formerly worked on a very large scale, many of the lodes show strong irony gossans, and the veinstone is usually quartz, the enclosing country being gneiss or gneissic granite. It seems not unlikely that the lead ores may occur chiefly in north and south lodes, while the copper is usually abundant in those having a more east and west range. As a general remark applying to most of the lodes on the west side of the district, I may say that the schists are usually decomposed near contact with ores, that there are numerous quartz threads tinted green and yellow, and a vast quantity of quartz in various states over the whole tract; that the quartz becomes more cellular and promising towards Najac on the south, and Figeac on the north, but especially the former, and that the granite occasionally changes its character, containing small crystals of hornblende. The quartz near the surface I observed to be constantly discoloured with phosphate of lead, frequently forming incrustations.

On the whole, there are unmistakeable proofs of the existence of great mineral wealth in the district now under consideration, and it requires only the application of a small amount of capital to secure very large results. Some few of the veins are already opened, and some no doubt have been partly exhausted, at least near the surface, but there still remains an ample supply

of ore for any one who will search for it with caution and prudence, provided there are the necessary means to carry on mining operations properly and to a sufficient extent, without demanding an immediate return.

There is no appearance of these mines having been stopped from want of water. The alteration of habits, the abstraction of the inhabitants of the valleys during the long and destructive wars of religion in the sixteenth century, and the absence of capital in the district to work the mines on a fit scale, are reasons amply sufficient to account for the cessation of mining work. During the middle ages, it appears, from documentary evidence, that the supply of silver obtained from the district was enough to justify the establishment of a mint in the town of Villefranche, but the introduction of the precious metals in large quantities after the discovery of America appears to have checked and ultimately destroyed this branch of profitable employment for the mining population. It is, however, interesting to observe that in the charter or letters-patent granted, bearing date December 1371, and confirmed by a royal edict dated 7th September 1373, the reason given for granting certain privileges to the town of Villefranche (including that of coining money) is the existence of mines of copper and silver discovered in the neighbourhood; whilst about sixty years later, in 1431, when other local mints were suppressed, that of Villefranche was retained, "en considération des mines d'argent qui estoient aux environs de la ville, et du profit qu'on tiroit du travail d'icelles." The last person who appears to have worked mines in the district was the last Baron de Savignhac, a Huguenot, who was killed, with a large number of his adherents, in the court-yard of his castle, near Villefranche, on the revocation of the edict of Nantes, and soon after the massacre of St. Bartholomew.

Another rich mineral field is known to exist near the towns of St. Afrique and Milhau on the banks of the Tarn. Here also are ancient workings, and numerous indications of rich and valuable lodes.

Among other curious proofs of the former existence of profitable mining establishments, there is, on the banks of the Tarn, near the small town of St. Rome de Tarn, a small village called *Le Minier*, close to a very remarkable lode which has evidently been opened and extensively worked. The houses of this village,

now occupied by the poorest class of peasants, are built in a style of architecture not known in the district, and with an amount of decoration in carving and other detail indicative of much taste and some wealth. On the capital of a small elegant fluted column, now used as part of a window-frame, I observed the date 1077, with an inscription, and there is good documentary proof that this and adjacent villages have once been of some importance in the district.

Between Le Minier and the pretty and flourishing town of Milhau, on the right bank of the Tarn, are numerous lodes, some of unmistakeable value and immediately available, others formerly worked and neglected, besides indications of many others not yet proved. On the left bank of the river, in the jurassic limestone, there are also veins opened, which would probably prove valuable if properly worked.

The rocks at and near the village of Le Minier, and the small gorge there opening out from the Tarn valley, are in a high degree picturesque. Blocks of a remarkably hard compact conglomerate are picked up in the bed of the little stream, and similar blocks have been formerly employed in grinding and pounding the ore. Veins of jaspery quartz are seen *in situ* close to the village, and a little above a dark blood-red porphyry appears to abound. Reports of native mercury having been discovered are current in the neighbourhood, and the close resemblance of some of the boulders I saw with the porphyritic rocks containing that metal at Obermoschel, in the Palatinate of Bavaria, near the town of Bingen on the Rhine, is a fact sufficiently significant to justify some search for cinnabar.

Perhaps the most remarkable and interesting of all the lodes in this neighbourhood is that of Galés; it is reached from the village of Peyre (where there are also veins) on the right bank of the Tarn, a few miles below Milhau. Crossing at this point a hill of considerable elevation which runs parallel to the course of the stream, we see from the crest of this hill another parallel to it, rising almost immediately, with the intervention only of a narrow valley, through which runs the 'Ruisseau des Lavadous.' Standing immediately opposite, the edges of the harder beds of the oolitic rock project in a bold escarpment beyond the surface, and exhibit in a striking manner a system of disturbances connected with a small axis of elevation bearing nearly north and

south, and running directly into the hill. The disturbances, although less marked, exist also on the face of the hill from which we look, and probably die away towards the river. Northwards they extend for about a mile, and are then also apparently terminated by another hill. Exactly in the axis of elevation, where the rocks have been broken and split up and a kind of chasm formed, the hollow thus produced has been filled by a white vein-stone, which on further examination proves to be a mixture of quartz and barytes, highly crystalline, and loaded with large quantities of blende and argentiferous galena. The top of the hill has been partly worked for ore on the crop of the lode for a long distance; but on opening from the side towards the Tarn, no remains were found of ancient workings, and operations have been carried on to some extent in three levels at a considerable height above the stream. In each of these the lode was at once discovered, and was found to be of large size, in excellent condition and full of ore. The direction of the lode is north and south, and it underlies a little to the west.

At the section of the same lode laid open on the hill-side, numerous indications of copper exist, but few of these appearances are justified by the present workings. The blende is abundant, but the great mass of the metalliferous portion is good argentiferous galena, and some hundreds of tons of rough ore are lying at grass, the value of which, when dressed, would be considerable; but nothing has been done here, in recent times, towards making use of the minerals extracted. There is a remarkable tendency to spheroidal crystallization in the ores of this mine. The magnitude of the lode is very considerable, but irregular, and the whole of the adjacent rock abounds with innumerable threads and small leaders of quartz and sulphate of barytes. Where exposed, the actual lode is about three feet wide, but the quartz threads extend for two or three yards on each side, and sometimes much more. They are generally complicated and follow no regular law. The workings on the lode appear to show a bearing somewhat west of north. The central line of elevation, as indicated by the position and axis of the intersected dome, is to the west of the lode, but not many yards. The ore exists in columnar portions, and the heap of stuff brought out from the lower level was better in appearance than that obtained from the upper part and the crop. The galena is

said not to be very rich in silver, but the specimens should be carefully tried for gold as well as silver *.

Passing on to the top of the hill above the upper level of Galés—a vertical rise of at least 200 to 300 feet—the lode is easily traced by a line of excavations made by the old people, and is clearly seen to bear at first towards north, but afterwards more west.

The soil, and the whole country immediately adjacent, is coloured by iron, having everywhere a deep red tint. The ground is cultivated towards the east to some extent, but presents on the whole a narrow plateau, over most parts of which the naked rock is exposed. The same is the case as far as the next ridge, after which limestone beds become more regular and the New Red sandstone deposits appear at the surface. In a position rather closely corresponding with the continuation of the direction of this lode, but without any visible connection, old works have been traced on the hill next beyond, but I am more inclined to attribute these to the existence of a cross-course containing good ore which has been opened on the road-side. There is certainly a considerable fault here, for the beds cropping out in the next hill are limestones, much higher in the series than the sands in contact with them. The former rocks are nearly horizontal, but the sands dip into the hill.

I noticed many other valuable lodes while traversing the hills and crossing the country in various directions, but as I do not wish to make this chapter a mining report, I will spare the reader further details.

On the whole, I have rarely seen a district more deserving the minute attention of the practical geologist and miner. It abounds with matters not only locally important, but highly suggestive in reference to the theory of mineral veins †.

* This was written before the present excitement on the subject of gold had even commenced. I am more than ever inclined now to advise that this suggestion be acted upon.

† A good deal has been written at various times on the subject of the Aveyron mines, and a detailed account of some of the veins was some time ago drawn up by M. Fournet. Within the last year also a memoir on the same subject appears in the *Annales des Mines*, the author being Monsieur Ad. Boisse, director of the mines of Carmaux. The account given in the text is the result of my own observations in the district, and does not, perhaps, in all respects run parallel to the descriptions referred to, since the

§ 3. THE LIMESTONE PLATEAU.

Overlying the granite, gneiss and other crystalline rocks, and the whole series of carboniferous and triassic deposits, the edge of the wide tract above described and a large district east and west of its southern portion are covered up by a vast capping of limestone of the jurassic period, locally called the *Pays de Causse*, but distinguished more conveniently as the limestone plateau. Forming part of this group of deposits, which are nearly horizontal over a great part of the range, are the iron ores of Mondaluzac already alluded to. The limestone is crystalline or semicrystalline, and very hard; deeply intersected by narrow valleys; and though really without lofty projecting peaks, it has all the appearance of a mountain country to the traveller in the valley or along the high-road. It contains some scenery extremely remarkable for its peculiar and picturesque character. It possesses a special fauna and flora, being the largest continuous tract of nearly pure calcareous rock at a very high level to be found in this part of Europe; and it is in some respects more like the high table-land of the interior of Spain, than the corresponding oolitic plateau of Bavaria, or the tertiary limestones of Carinthia. I have been across the district in several directions and on more than one visit to Southern France, and have lingered in some of the valleys, examining carefully their nature and peculiarities. I will try to give a brief account of the points most worthy of notice.

The rocks here belong to the middle part of the secondary series, and chiefly to the lower part of that series. They are almost entirely limestones,—of considerable thickness and in

tendency of the French mining engineers of the present day is to view all the phenomena of mineral veins in connexion with certain theoretical views of their origin, little appreciated by English miners.

The theory of approximate parallelism of contemporaneous veins, suggested by Monsieur Elie de Beaumont, however ingenious and apparently applicable in many cases, does not seem to me calculated to give real assistance to the mining engineer. The formation and filling up of mineral veins depends on too many local causes to be anticipated without minute inspection in each particular case, whilst the value of the mineral contents cannot be decided, even if their existence is proved, by reference to any view that may be taken of the date of the crevice originally made in the rock, or system of rocks disturbed.

the most magnificent development,—raised by mechanical force from great depths, long after the rocks were consolidated and altered; lifted up in all likelihood slowly and gradually, but cracked and widely fissured during this upheaval. Every important valley, if not every gorge, seems to have been originated by the contraction that took place when the mud, of which they were formed at the bottom of some ocean, first became a compact dry rock, and when, in consequence of drying and thus parting with a large part of its volume, it came to occupy a smaller space, and while shrinking assumed a peculiar series of forms, strictly depending on the action of forces of a chemical nature, not unlike those which determine the construction and texture of crystals.

This great limestone plateau of France occupies several hundreds of square miles, and is a part of a vast calcareous deposit, which in the Alps has been affected by elevations of the first order so far as Europe is concerned, but which elsewhere in Europe has been left comparatively untouched, except by the infinitely slower and smaller upheavals which have just succeeded in bringing it into view in Russia, Germany and England, but have not even lifted it above the sea in other parts where it was deposited, and where it still remains to be subjected, perhaps, to future movements of the same nature. The district we are now considering is a plateau that forms the western extremity of the High Alps, and it shows the final termination of the mighty movements to which Mont Blanc is due, and well illustrates the peculiar structure that seems always to characterize strata that have been long exposed to disturbance, or to contact with disturbed rocks. It is almost surrounded by rocks so highly altered by crystalline action, as to have lost the appearance of mechanical origin. It is elevated several thousand feet above the sea, and is split asunder in many directions by wide gorges and narrow fissures, through some of which considerable rivers pass, while others are dry, wild, and not connected with each other in any way. Much of the whole district is almost bare of any other vegetation than wild herbs, for trees cannot find place for their roots, and for some reason or other, (perhaps the total absence of silica,) grasses do not seem to flourish.

There is something singularly wild and strange in the impres-

sion produced on entering this country after crossing the fine volcanic district of the Auvergne, generally much more cultivated in consequence of the greater value of decomposed lava as a soil. The scenery indeed changes considerably, and one is fully prepared for the limestone by passing over the dull and barren tracts occupied by gneiss and schists of various kinds. These are bleak, and if grand, are only so in form; but when we reach the calcareous rocks, the character suddenly changes, and if not more cultivated or better draped with vegetation, there is at least more appearance of colour and variety in the objects around. The hills are square or pyramidal, with sharp angles and very bluff precipices: the rocks are of a whitish-yellow or reddish-white colour, and exceedingly broken and rough in appearance: at the foot of most of the hills is a mass of debris constantly increasing and forming a considerable talus, and at the bottom generally runs one of the numerous streams characteristic of the district. Here and there perhaps will be seen some gigantic representation of a fortress, or the fantastic shadow of an old castellated mansion gloomily frowning over an abyss. At a little distance a towering mass of shapeless rock seems suspended, overhanging a narrow valley; in another place an isolated and perfectly detached hill is surrounded by higher bluffs, separated from it only by narrow gorges; and at distant points a few flocks of sheep, with their herdsmen, are dispersed about, but there is rarely a village or human habitation of any kind. The villages are chiefly in the more open parts of the valleys, and no small farm-houses or châteaux break the monotony of the surface.

The chief wealth of this singular district is derived from the sheep pasturage, and this consists almost exclusively of a growth of aromatic herbs, of which thyme and lavender are the most abundant. On an area of more than a quarter of a million of acres are fed about 100,000 sheep and a few thousand goats. A few herdsmen look after these flocks, and are paid a certain sum per flock for superintendence, milking, and making cheese, for which latter purpose there is taken an admixture of one part of goat's-milk to a hundred parts of sheep's-milk, no cow's-milk being added. The cheese, when made, is almost all conveyed to the small village of Roquefort, situated on a very high portion of the plateau some miles from St. Afrique, and

the metropolis of an important trade in a peculiar cheese, which receives its name from this place.

To reach the village of Roquefort requires a long detour and much steep climbing, and it seems at first very extraordinary that a place so difficult of access should have been selected for collecting and selling the cheeses of a large district. On inquiry, however, we find that there is an excellent reason in the existence of cellars cut out of the limestone, the air of which in this particular place appears to retain constantly a peculiar freshness and coolness, even during the greatest heats of summer, permitting the cheese to ripen thoroughly without decaying. This is the more important in the case of cheese made from sheep's-milk, which is always rather strong, and would be disagreeable even to the taste of those most accustomed to strong flavours, if it were allowed to proceed a step too far.

I was desirous of visiting one of these cellars in order to learn the reason of the phænomenon alluded to, which is a good deal talked about in the district, and the details of which are greatly exaggerated. On reaching the immediate neighbourhood and examining the rocks, which are well seen in naked bluffs and are also more or less exposed at the surface, it was evident that there existed a good geological cause for the peculiarity exhibited by the caverns; and on entering the village and seeing some excavations at that time making for new and larger cellars than had before been prepared, I came to a conclusion fully borne out afterwards on going down into an old-established cheese-cellar, and learning the particulars of their construction.

It appears that the limestone in the wide tract I have described is so far metamorphic in its character, and has advanced to such a stage in the process of crystallization, as to have acquired regular and systematic structure, large and very numerous open fissures extending vertically downwards, probably towards the contact of true crystalline rock, and crossing each other in various directions. Through these innumerable open crevices air passes freely, and the temperature of the air in them will necessarily be far less variable than that at the surface, being colder in the warm days of summer and warmer in winter. The cellars are cut out of the rock, and in most cases the walls contain one or more broad cracks, within which if the hand is placed a current is distinctly felt. Such fissures communicate with other crevices, and possibly

in some cases with a vast network of subterranean openings through which the air traversing is cooled down to the temperature of the rock, just as water passing through rocks acquires their temperature, and thus comes out to the surface in Artesian wells, either cooler or warmer than the air according to the time of year and the circumstances of the case. It will easily be understood, that in these artificial grottos, the lower chambers are those in which the air is coolest and the temperature least changeable, and advantage is taken of this in preparing the cheese. In the establishment I visited, there were three stages one below another, in each of which cheeses were placed, being removed gradually to lower cellars as they ripened. Each stage contained from seven to eight hundred cheeses, weighing from two to four pounds each. The cheeses are coloured by a powder obtained from stale brown bread, and streaks of green mould are obtained by mixing occasionally a peculiar moss which is specially prepared for this purpose. About 100 women are employed in the manufacture and preparation of the cheeses, and the quantity made in a year is stated at 30,000 cwt.

CHAPTER THE THIRD.

THE PLAINS OF LANGUEDOC AND GASCONY—THEIR TOWNS, ANTIQUITIES, AND INHABITANTS.

THE South of France, especially the wide tract extending between the Mediterranean and the Bay of Biscay, forms a kind of neutral ground between France and Spain. The people and their language are more Italian and Spanish than French, while the cities and public monuments exhibit such frequent and perfect remains of ancient Rome as to give them a peculiar interest simply on this account. The noble amphitheatres, beautiful temples, gigantic aqueducts, handsome bridges and other Roman antiquities, often on a large scale, and so common as to be characteristic of the district, contrast strongly with Byzantine and semi-Moorish constructions, while the inhabitants show a corresponding mixture of races in their dark eyes and hair, the great beauty of their features, and often by a singular admixture of various styles of beauty due to the successive presence in the country of very different tribes.

Thus Arles has long been remarkable for the Moorish blood retained in the principal families, and this is perfectly manifest even to the passing traveller. Nîsmes is no less interesting for its Roman antiquities, in which it is excelled by few towns out of Italy. Its origin dates back to the most remote antiquity, and one of its monuments consists of a strange conical tower called the *Tour magne*, now in ruins, rising almost like the fragments of a huge and lofty glass-house, and belonging to that rather extensive class of old buildings, some specimens of which are found in most countries of Northern Europe, in which the absence of any perceptible utility keeps alive the curiosity of antiquaries by an endless series of conjectures. It is placed on a considerable natural elevation, and has long served as a watch-tower. From its present summit, no doubt much below the original one, the coast-line of the Mediterranean is seen near Cette, and the greater part of the Delta of the Rhone is within the range of vision. There is still about 90 feet of the original

building left standing, and the form of the building as well as its ruined state combine to render the ruin highly picturesque.

The most remarkable object seen from this tower is a noble Roman amphitheatre immediately below and half-buried among the buildings of the town. Hardly any public edifices exist, which bring so vividly before the mind's eye the essential peculiarities of the great Roman people, as these fragments of amphitheatres when in a tolerably complete state. The strongest and most unchanging nationality seems always to have been preserved amongst the colonists so frequently drafted off from the parent city, and even the faults of such a people as the Romans, bad as they often were individually, generally assumed a character both grandiose and magnificent, reminding one of the state whence they sprung.

But the amphitheatre of Nîsmes is really in itself a noble building and a highly picturesque ruin. Its state of preservation, in spite of the numerous accidents to which it has been exposed in the course of seventeen or eighteen centuries, and the more injurious barbarisms of those who have used this as well as others of the noblest works of ancient art as mere quarries, conveniently supplying materials for the construction of houses, palaces or churches, is still extremely good. Its external preservation is even more perfect than that of the great Coliseum of Rome. Whole ranges of seats yet remain, rising in regular tiers one above another. Each range is constructed of a number of enormous square blocks of stone, some of which retain marks and notches indicating the amount of space allotted to each spectator. We may still see the noble galleries, varied in their style of architecture, but all good, and many of them uninjured by time or violence,—the magnificent stairs and passages admitting of the free access and egress of the vast multitude, and the complete division of different classes distinctly and unchangeably preserved.

So perfect are many parts of this building, that one may sit down and without much indulgence of the fancy carry back one's thoughts to the time when the charm of novelty was added to those intrinsic beauties we can now recognize, and when the old Roman spectator occupying the same seat was waiting with anxiety and intense interest to see the cruel and ferocious sports then thought manly, and considered absolutely essential to keep up the national character. Seated near the centre of

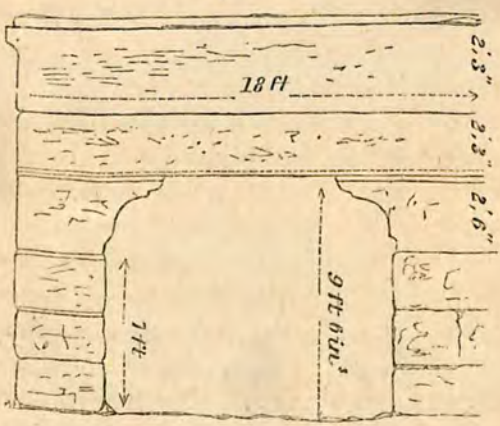
the lower range of seats not far from the imperial throne—part of the iron-work enclosing which is still to be seen—some proud senator looks around him on all that is noble and distinguished in the ancient city of Nemausus, and watches the representative of majesty, or majesty itself, clothed in purple, mounting to the imperial throne. Above him on the next tier are the knights; above them the Roman citizens—Roman at least by law, though few if any had ever seen Rome—and above them again the bondsmen and slaves, who in those days were not only allowed to partake in the amusements of their masters, but had their allotted places with the rest. More than 20,000 human beings are seated quietly around awaiting a signal. Soon a small door opens—the place of that door is now visible—and there rush out wild beasts to combat either with each other, or with those gladiators, whose gloomy chambers are also preserved, and who, one must imagine, were scarcely more civilized or domesticated than their victims in the arena. These fights would, however, soon be succeeded by others more terrible. Men against men, —the condemned criminal and the innocent Christian, led out of other dungeons, are cruelly tortured and put to death for the amusement of their fellow-men. Such are the scenes that suggest themselves as we occupy the seats, traverse the galleries or visit the small chambers, that remain so perfectly preserved in this noble structure. We almost expect to see the marks of blood still staining the ground. We listen to hear the shouts of the multitude, and when we recall our wandering thoughts, and watch the existing population of the vicinity, we cannot but feel that if these things have passed away, we have lost also the indomitable courage and constantly advancing progress which once belonged to the inhabitants of Southern Europe, but which has now changed into a tame and debasing superstition, involving a total want even of the power of union, and the most degrading subjection to tyranny. The Roman spirit of proud independence has either passed away or has become mingled with many other less valuable and less hopeful ingredients, but the tendency to cruel and bloody amusements is apparently still in existence, and may at any time reappear when the passions are excited and circumstances are favourable for its development. These reflections can hardly appear out of place, as they suggest themselves but too readily to any one acquainted with the former

history and present condition of the French, Spanish and Italian people, especially as illustrated in Provence within the last half-century.

In this amphitheatre, the interior of the arena, occupied by the combatants, is a very well-proportioned oval, the longer axis being 437 feet and the shorter 332 feet. The total height of the building is 70 feet. The number of ascending ranges of seats was thirty-four, and the total number of persons accommodated with seats is estimated at 22,000. Of the seats almost all those of the middle part are now destroyed, but the upper and some of the lower are quite perfect.

Among the most remarkable points of detail may be mentioned the galleries or corridors, especially of the middle or knights' tier. These are constructed in the thickness of the wall, and are formed in some cases by single blocks of stone measuring as much as 18 feet long. An idea of the effect of these flat-topped arches may be obtained by looking at the annexed cut (fig. 5), where the opening of the arch as represented measures 10 feet in width.

Fig. 5.—*Square arch in the gallery of the Knights, formed of solid blocks of stone.*



The whole of the masonry of the building is composed of smoothed blocks of stone simply placed together without cement; but it must be observed, that in doing this, the architect has shown a perfect knowledge of the kinds of stone obtainable in the neighbourhood, that which is selected being well adapted both for the quarrying of large blocks, and for their being perfectly

smoothed at small expense. In some places, especially at the sides of the staircases leading to the people's gallery, the stones have been polished by the frequent crowds formerly pressing through the narrow passages.

A curious contrast must be offered, when, as is sometimes the case, this amphitheatre is made subservient to the fêtes of the present inhabitants of Nîsmes. We saw placarded on the walls, notices of a contest between two modern gladiators to take place in a few days, and the young oxen of the marshes are occasionally driven into the arena to be tormented and branded for the satisfaction of those who choose to pay a few sous for the sight.

There are other hardly less interesting objects in this town. An exquisitely beautiful though small temple of late Roman architecture is now converted into a museum. It has passed through many phases between the date of its consecration by Augustus and the present time, but retains much of its beauty in spite of all. Few more striking examples can be desired of the taste of the former inhabitants of this place, and it is not necessary to look far, if we wish for a contrast in the more modern buildings around. Other temples also exist in the neighbourhood, one of which dedicated to Diana is in ruins, but still highly interesting; it abounds with fine specimens of delicate workmanship, and appears to have been connected with adjacent very extensive baths, also of Roman workmanship.

The old town of Nîsmes appears to afford picturesque objects of various kinds. A long double canal with about 150 washerwomen exercising their vocation in the open air, reminds one forcibly of the peculiar tastes and tendencies of the inhabitants of this part of France. Bright colours and loud voices are certainly not confined to Provence, but they here assume a kind of individuality easy to recognise, and very characteristic of the district.

Many objects of interest in the vicinity of the town are well worth a careful examination, and of these the celebrated aqueduct called the Pont du Gard is certainly the most remarkable. It is a construction of almost Cyclopean grandeur, crossing a wild valley some twelve miles from Nîsmes, and evidently intended to convey a supply of water to the town, with which it is connected at sundry points. Seen from the road the appearance is very striking, as there is a singular admixture of vast and

massive strength and stability with lightness and even elegance of detail. It consists of three ranges of arches placed one over another, the lower being nearly seventy feet above the middle of the valley, the second the same height (seventy feet) above the first, and the uppermost much smaller, about thirty feet above the second. The length of the upper tier is 873 feet, and the channel for the water does not give an area of so much as one square yard. Nothing can better mark the accuracy with which this remarkable work was designed, than the nature of the injury done to it some years ago by a foolish attempt to render the middle tier of arches more available, by cutting away a portion to form a bridge. The injury is irreparable, though the portion removed was very small; but with this exception, the effect of eighteen centuries that have elapsed since its construction seems to be scarcely discernible. It is a rare monument of ingenuity and labour, but the purpose is one that would now be obtained far more readily by other less costly means.

Fig. 6.—*View of the Pont du Gard.*

The country immediately around Nîsmes, and between it and Montpelier, is not particularly interesting. To the north, near the Pont du Gard, there are numerous wild valleys of naked limestone rock, but these give place towards the south to a very stony and scanty soil on nearly level or slightly undulating ground, extending to the broad flat marsh of the delta of the Rhone. There is a railroad between the two towns, offering no works of importance beyond a few deep cuttings. The land all

around is richly cultivated, being covered with low vines and olive-trees. Numerous small villages, and one town, Lunel, celebrated for the sweet wine of that name, are dotted over the plain; but there are no inhabitants to be seen, except where a few men and women, and perhaps a mule or two, are beating out the corn with their flails, their mallets, or their feet.

Montpelier as a town is eminently uninteresting, and though correctly described in Murray's Handbook, is by most persons who have not seen it, greatly overrated. Not only the clouds of dust, the never-ceasing wind, and the rows of white houses closed with white jalousies, but the whole aspect and condition of the place seems dull and tiresome. The streets, and especially the market-places of the old part of the town, are in some measure redeeming points, but not enough to justify lengthened description. There are a few objects of interest, amongst which may be mentioned the University and the Botanic Garden, but there is a want of characteristic and striking features. Montpelier is far too much of the modern watering-place to be attractive to any traveller in search of the picturesque, whether he admire nature or art.

Immediately outside the town there is an elevated platform, the Promenade du Peyrou, very celebrated as one of the grandest of public walks. So many towns vaunt their supposed pre-eminence in this respect, and the resulting discussions are so little profitable, that I will not here trouble the reader with anything of the kind. Suffice it to say, that whatever Montpelier and its stony walk may be in winter, they certainly are not the most pleasant places to visit in the month of August.

From Montpelier to Narbonne the country is for the most part level or undulating, crossing the tertiary and alluvial tracts which border on the Mediterranean, and running close along the side of the ancient delta of the Rhone. Between the road and the Mediterranean there occurs a long and singular range of ponds, the remains of the ancient bed of the river before the present delta and channel were formed.

It is not improbable that a careful search in this neighbourhood, towards the south, might be rewarded by the discovery of very distinct proofs of recent elevation. In the time of the Romans the bed of the Rhone certainly took a western course, and the sea probably advanced up the present delta for many

leagues *. At Agde, about midway between Cette and Narbonne, there are basaltic columns accompanied a little way out at sea by a large shoal. The deltas of the rivers Aude and Rhone are separated at Cette by high cliffs of jurassic limestone, reaching northwards towards Montpelier, and there covered by outlying lower cretaceous deposits; but the coast-line between Cette and the mouth of the Aude has no doubt been much modified in recent times. It is near this point in the Etang du Thau, that the Canal du Midi, one of the most important public works of France, enters the Mediterranean. The canal, sixty-five feet wide at the surface and thirty-three feet at the bottom, was commenced so long ago as 1666 and terminated in 1681, and remains a permanent and noble memorial of practical skill. It is not so much used as might be expected, notwithstanding the fact that it connects the waters of the Bay of Biscay with those of the Gulf of Lyons; but the communications of the present day require both speed and cheapness, and the amount of business done between the eastern and western coasts of the South of France is by no means so great as it ought to be, and must soon become. The railroad from Bordeaux to Cette when completed will certainly develope a great traffic, and in all probability the good effect will not end with the railway, but extend to the canal and even to the roads.

Narbonne, situated in the plains traversed by a branch of the canal, and close to one of the large ponds (*étangs*), or salt lagoons, which abound on this coast, is a somewhat dull town, with the country around naked and dreary, and though fertile in corn rather unhealthy. The honey for which the place is celebrated, is produced from the bristly plants and tufts of heath growing on the limestone rocks near.

Soon after leaving Narbonne the outline of the Pyrenees begins to show itself, at first looming hazily in the distance, but gradually becoming more distinct. This outline is pleasing, but

* The advance of the delta of the Rhone in some parts has been much more rapid, amounting, by means of the *teys* (low islands of sand partly covered by vegetation), to as much as a league in a century. In the year 1796 it is recorded by M. Fabre, a French engineer of eminence, that since 1711, when a certain tower was constructed at the extremity, the termination of the delta had advanced into the sea about 6400 yards (5847 metres), a gain of upwards of 75 yards per annum.

not striking, as the heights seem inconsiderable, but something of the peculiar mural character of the range is seen in the extreme abruptness with which even the flanking hills rise from the plains.

Leaving Narbonne after an early breakfast, we reached Perpignan between two and three. The picturesque walls, towers, and fortress of this ancient town are visible from a distance, the whole being built on a small eminence on the banks of the Tet, in the midst of the alluvial and gravel plains of Roussillon; and they are very interesting, not only as picturesque objects, but for the historical recollections they cannot fail to call up. As it is only within about two centuries that this city, the capital of the province of Roussillon, was permanently united to France, it is not extraordinary that we here sensibly perceive an approach to the Peninsula, by a marked change in the style of houses and the costumes of the inhabitants.

The plain of Roussillon is extensive and very level, and is traversed by numerous mountain torrents, chiefly connected either with the Tet or Tech, and coming down from the Pyrenees. I shall have subsequent occasion to notice the gravels which cover much of the Peninsula, and which suggest similar reflections to those appearing here. I only mention here the fact of such gravels existing north of the Pyrenean chain.

The whole of the extensive tracts of low level ground at the northern foot of the Pyrenees, forming the plains of Roussillon, Languedoc, and Gascony, are of nearly the same character, and are chiefly occupied on the Mediterranean side by extensive pastures, and towards the Bay of Biscay by wide sandy plains. At various points along the whole district, the Pyrenees are seen in the far distance rising as a lofty unbroken wall, and forming the one only feature of interest in the landscape.

On the Atlantic side near the coast we have the important frontier town of Bayonne, which is a very lively picturesque place, some parts being old, with narrow streets, projecting houses, and low stone or brick arcades, not unlike those of Chester, while other parts of the town are modern, and consist of broad streets, open *plazas*, and lofty regularly built houses, all brilliant with whitewash. There is an interesting cathedral, recently repaired, with some cloisters attached, of a good style of architecture. Bayonne is situated on a small stream not far from the sea, and

the shipping comes close to the town, although the port is bad. Biarritz is a small bathing-place on the coast, about five miles off, and is celebrated for the numerous caverns existing in the limestone rock, which there forms precipitous cliffs. The sea, when disturbed, and this is almost always the case, rushes into and through these caverns at a fearful rate, constantly tearing away large portions of the walls, and eating out fresh hollows.

From Bayonne, the road across the plains towards Pau, and thence to Toulouse, runs parallel with the great Pyrenean chain. I have only travelled this road once, and on that occasion the weather, though fine overhead, was too misty towards the south to allow of my obtaining fine views of the mountains, except at intervals. The road is rather tiresome, passing over a succession of low but steep hills, forming a kind of rolling prairie, over which the horses rarely go at more than a foot pace. On each side of the straight line of carriage-way are rows of poplars which appear interminable, until at length the neighbourhood of Pau is reached, and comfortable-looking houses take the place of the poplars. The general aspect of the entrance to this town is not unlike that of Bath or Cheltenham, which in many respects it may be said to resemble.

But neither Bath—much less Cheltenham—nor any other town that I have seen, unites so much of the true picturesque with the comfortable, or has so many interesting points of view, combined with such grand and magnificent mountain scenery and such rich and well-cultivated landscape in the foreground.

The castle, the birth-place of Henri IV., whose cradle is preserved in one of the rooms, rises out of the middle of the town, surrounded by a natural moat overlooking the river or rather torrent (the Gave de Pau) which rushes past, and separates the town from the cultivated land towards the mountains. Small, and destitute of any claim to architectural beauty, this castle is yet as pretty as it is historically interesting. There are several towers (five) rising from different parts, one of them to a height of 115 feet, and another 80, the latter having the disgraceful reputation of containing oubliettes. There are at any rate several dungeons in the thickness of the wall. There was originally no opening in this tower (which is detached from the outer wall of the castle) to a height of forty feet from the ground. The accompanying view (fig. 7) shows the castle and

some of the towers. The interior has been much restored of late years.

Fig. 7.—*View of the town and château of Pau.*

The streets of Pau are irregular, being grouped on several almost detached platforms and connected by bridges. There are several public walks, from which may be seen noble views of the Pyrenees, amongst which the Pic du Midi de Pau rises crowning the whole range. Generally these mountains are remarkable for the want of that broken and varied outline which gives to the Alps their most striking beauties, but here there are not wanting marked projections from the usual dark serrated wall presented by the chain, and the Pic du Midi is one of the very finest of all. The lithographed view of this mountain in the annexed plate is taken from a nearer point than the town of Pau, but the form and general appearance are always similar and are easily recognised.

Pau is the central point from which the Pyrenees can best be visited, and although not provided with all the luxuries and comforts of the large cities and frequented towns of Switzerland, nothing essential is wanting in the different hotels of the place, to enable the traveller to enjoy himself and see the country. The number of English here during winter is generally considerable, and the climate is said to be delicious, as snow rarely falls, and never lies long on the ground; the air is usually temperate, and the vegetation clearly shows that frosts are not severe. One

great advantage it certainly possesses over other towns in the south of France and north of Italy, namely the absence of those terrible winds which are so common elsewhere during the spring. As a place for the early winter, Pau must certainly be delightful; and for the spring it is safe, if not so pleasant.

The costumes of the peasants here and further towards the heart of the French Pyrenees are curious, and well worthy of notice. The language of this part of France is also remarkable. In the Val d'Ossau, a few miles due south from Pau, and in a mule-track entering Spain, near Canfranc, whence there is a road by Jaca to Saragossa, the peasants wear a peculiar wide brown cloth cap, short jacket, and knee-breeches, with a bright sash round the waist, whilst the women have on the head a kind of hood, serving both for bonnet and thick mantilla, and also a jacket, both of some bright colour, usually scarlet. In this dress there is much to remind one of some parts of Spain. Both sexes wear shoes or sabots with a kind of wide fall at the ankle. At Barèges, a well-known watering-place, some miles further to the east, the costume is quite different with the exception of the hood, which is indeed found all over the South of France, from Orthés to Foix, and as far north as Toulouse. At Barèges the men's caps are peaked and scarlet, and their legs are covered by gaiters, while the sash is neglected. At Luchon, still further east, the men wear broad hats or Catalonian caps, and the general appearance both of them and the women is altogether peculiar, reminding one a little of the gay holiday costumes of some parts of Castille. About Pau itself there is a mixture, gradually changing as we get towards the central part of the great plains of southern France, as far as Tarbes and its neighbourhood, where a singular variety prevails, evidently including peculiarities of various places and distant periods.

The country from Pau by Tarbes to Toulouse is remarkable for rich cultivation. The first part of the journey affords magnificent views of the central part of the Pyrenees, with numerous snowy patches and sharp peaks. I have already directed attention to the great difference observable between these mountains and the Alps, the other principal European chain, in the broad, flat, wall-like character of the Pyrenean chain, and the absence of large gaps, of which, in fact, there is only one from the commencement of the higher part of the range

W. Parker, del.

Day & Son, Lith.rs to the Queen.

VIEW OF THE PIC DE MIDI DE PAU — PYRENEES.

at the Canigou, near the Mediterranean, to the Asturias. We also see, in traversing the country eastwards, that there is an almost total absence of distinct lateral or flanking chains, only one such chain being seen between Pau and the central ridge, and that one being low and unimportant. It is, however, only in Spain that the real nature of this singular and most important range is seen, and there only by studying the country in a large and comprehensive manner. The granite mountains of Guadalajara near Madrid, appear to be much more a portion of the central Pyrenean chain than a detached mountain-system, while the remarkable limestone ridge of Pancormo, traversed in passing from Burgos northwards to Vittoria, is an instance of partially altered rock pressed up between two undulations of granite, and belonging also to the great chain itself. In fact, the Pyrenees seem to form merely the northern termination of one broad but not very lofty series of mighty undulations, extending over a wide space, and having occupied a long period in their production, which terminated at a comparatively recent date. These undulations must have been carried on while the whole series of rocks were buried far beneath the level of the sea, and the lifting up of the mass has taken place gradually, without any great shock or sudden elevation. I think also there is good evidence in proof of the lifting up being a process that has proceeded slowly but incessantly up to a very late period, even if it is not now going on.

At the present time the means of communication across the great plains of the South of France are very imperfect, and limited to slow diligences for passengers, and the canal for heavy goods. The railway will shortly supersede these entirely, and cannot fail to develope the natural resources of the country to a great extent. It is capable of yielding large quantities of corn, wine and oil, and though at present poor, possesses all the material of great wealth.

Connected on the one side with Bordeaux, and on the other with Marseilles, situated on the great highway between the Atlantic and the Mediterranean, and possessed of a delightful climate and a good soil, there can hardly be a limit to the advance that may be anticipated in agriculture; while there exists in the Pyrenees, at no great distance, an abundant store of minerals capable of yielding gold, silver, lead and copper, and

only needing the introduction of a moderate amount of capital after the establishment of cheap and rapid means of transit.

There is also another prospect for this part of France. Between Montauban and Madrid there would appear to be an available line for the construction of a railway, entering the valley of the Ebro near Saragossa, and passing through that important town on the way to the metropolis.

Should such a line be constructed, there would be made available an entirely new outlet for the productions of one of the most important provinces of the Peninsula, and there would be an additional chance for the regeneration of that fine country by the means which of all others are the most rapid and the most effectual.

SWITZERLAND.

I. WALK FROM LAUSANNE THROUGH THE JURA VALLEYS.

II. MEETING OF THE FRENCH GEOLOGICAL SOCIETY AT PORRENTRUY IN 1838.

SWITZERLAND.

CHAPTER THE FIRST.

WALK FROM LAUSANNE THROUGH THE JURA VALLEYS.

THE meetings of scientific associations in different parts of Europe often exhibit a good deal of national character and amusing incident, as well as of that scientific lore which is of course the main object of the *réunion*. Such meetings seem to have originated in Germany, but they have since been continued on a larger scale in other countries, so that now and for some time past there have been several societies regularly established for the purpose of holding peripatetic meetings in different parts of the continent. Thus there is the German meeting of naturalists and physicians, small, but of some standing and value. Our own British Association has taken a very high rank amongst similar assemblies; the French have three or four such societies for different sciences; the Swiss have one; the Scandinavians meet in a similar way from time to time, and the Italians communicate, or would communicate, with each other from year to year by large meetings of this kind, if the political state of the country admitted of a dozen or twenty people being together in a room without a number of spies being present to prevent science from being made use of as a handle to rebellion.

I have not myself been a very frequent attendant at the meetings of any societies; my summers for many years having been occupied in travelling, chiefly in parts of the world where Englishmen do not thickly congregate, and I have always rather preferred the distant and less accessible places to those which, from whatever circumstances, are fashionable and more frequented. Still, in the course of my wanderings, I have fallen in occasionally with the travelling societies, and have taken up my lot with them. I propose to give the reader accounts of one

or two of these meetings, although of rather ancient dates, where I was not supported by fellow-countrymen, thinking that these may possess greater interest than accounts of more recent and better known assemblies.

In the year 1838, during my first visit to the continent, a meeting of the French Geological Society was held in the town of Porrentruy, in the north-west corner of Switzerland, not very far from the Vosges Mountains and the Mountains of the Black Forest. My notes of that date enable me to give an account of a walking excursion to this place from Lausanne, and a sojourn in the town during the week of the meeting, part of which was occupied in an expedition which afforded much matter for amusement.

Before proceeding with my story, it may, however, be well to say a few words concerning the French Geological Society, and also as to the place of meeting, which is probably very little known, even by those tolerably familiar with Switzerland. If the reader will take a map, either of Switzerland or France, and search in the north-western part of the Canton of Berne for a small piece of that canton which juts into France, and is surrounded by it on three sides, he may find marked, in rather small letters, the name Porrentruy, or Pruntrut, the latter being the German denomination. It may be described as about seventy miles east of Besançon, and rather more than 100 north of Lausanne. It is situated in one of the valleys of the Jura, enclosed by hills of moderate elevation, and is said (I know not with what truth) to exist rather by the smuggling propensities of its inhabitants, than by any legitimate trade or manufacture. At all events, there is very little of either of the latter to be observed. With this short notice, I must proceed to say a word concerning the French Geological Society.

This society, unlike most of those on the continent, is founded on an English model, that is to say, is expensive to its members, and with the greatest liberality opens wide its arms to embrace all, whether natives or foreigners, who have no objection to paying sixty francs entrance-fee, and thirty francs per annum besides. It was still in its youth at the time I speak of, but has since become more distinguished; and now numbers among its foreign members some of the most eminent continental and English geologists, and has published a large number of valuable memoirs.

This society, besides its regular meetings, calls together its members annually at some town in France or the neighbourhood, choosing for the place of assembly a district interesting for local geology. It will now be understood how a French society happened to hold its meeting in Switzerland, and the little town in question, otherwise quite unimportant, was fixed on, because of its convenient distance from some of the most instructive secondary geology of France or any adjacent country.

In order to reach Porrentruy from Lausanne, where I was staying for the summer, two roads were open to me, the one by Berne, Soleure, and Délémont, by the diligence; the other by the valleys of the Jura, only practicable on foot. Being anxious to see the scenery within the ranges of those very interesting mountains, and being, moreover, a tolerable walker, I chose the latter, and had no reason to regret my determination; and as the journey has not often been described, I transcribe here a few passages from my journal of that date.

The road from Lausanne towards the Jura is full of beauty and interest. Almost as soon as the town is fairly left behind, one feels dropped as it were into a district which resembles closely the prettiest and quietest scenery of the middle of England. Were it not that on looking in the direction of the lake of Geneva the Savoy Mountains are still visible, Mont Blanc towering above them in all his snowy magnificence, the illusion would be quite complete, for the few vineyards that there are, look very much like hop-yards, and the rest of the cultivation is quite English, consisting of corn, clover, meadow land and orchard, prettily varied and set-off by quickset and other hedges. The cultivated ground lies on the slope of a gently rising hill, which has not the least pretensions to be called anything but a hill, and lasts for some few miles, a few Swiss houses coming in now and then to improve the picturesque effect and harmonize with the mountains. In this way, the road passes a château and a village or two, but gradually becomes more open and less English,—the mountains, when they are really seen, altogether removing any grounds of comparison.

After walking rather more than two leagues, I stopped at a neat-looking public-house, in a small hamlet, and obtained some excellent ham, cheese, bread and wine for dinner. I was looking at my map while the meal was preparing, and thus

attracted the attention of the landlady, who at once took it from me, and after looking for the large towns she knew of, was rather annoyed at not finding her own village (Mèx) among them. There were two men in the room who were anxious to help in the discovery of this important place, and all concluded that it must be somewhere, although they could not find it. It was amusing to see the deep interest which these people took in the matter. They could evidently read with great ease, and they quite understood the meaning and use of the map, but they did not like the omission of their native place. They were not less than twenty minutes amusing themselves thus; and while this was going on in one room, I could hear in the next, which was the kitchen, the voice of a little boy not more than six or seven years old reading his letters and beginning his education. The cleanliness, good-will, and perfect simplicity and freedom of manner in these Swiss peasants pleased me very much. They have, however, one great fault,—the men are sad drunkards, so much so that one can hardly walk about in any direction after dusk, especially on market nights, without proof of the prevalence of this vice.

Leaving the little hamlet of Mèx, I walked on through a pretty country, and after some time came upon another beautiful prospect, entirely different from that which I had seen in the morning. Not far from the road, and coming into view by a sharp turn, there rises suddenly, from a noisy, babbling brook, a richly clothed hill of simple but picturesque appearance. The height is considerable, and quite on the top is a remarkably pretty church, with a fine square tower, rather lofty and crowned with a spire. This and a house near it were the only buildings visible, and they stood out so boldly in the clear atmosphere against the intensely blue sky, that I thought I had never seen buildings look so well. Just before me was a little stone bridge; to the right, a cross road leading up to a small house in a wood; and the road on which I was travelling, wound about so much, in order to make the way up the hill practicable, that it was only seen for a very short distance, and then was quite lost. This was the appearance in front. On turning round one might observe the broad valley between the Jura and the Savoy Alps, in the foreground beyond these extended the lake of Geneva, and rising from the lake, the mountains stood out in a long line of jagged

and broken summits, as clear and distinct as if they had all been within a stone's throw.

Coponex itself, whose church and, I fancy, parsonage I have just described, is a tolerable town and of good size, but the view of it from a little distance is more striking than any afterwards seen. Soon after passing the town, I turned from the high road to a village about a mile off, where I was astonished at the well-looking, well-furnished house that I entered in this out-of-the-way village. The wife of the owner, who was not himself at home, soon provided me with a simple meal, and after some conversation it came out that she could speak English. This in a little village of a dozen houses, far enough from any large town, and in the case of a woman who had never in her extremest wanderings ventured beyond Berne, even in her native country, was certainly not to be expected.

Quitting these hospitable people I made my way by some other villages to the foot of the Jura, and soon began to ascend a high pass near Mont Tendre. It took two hours to get to the top, but every now and then I was amply rewarded by looking back upon the range of mountains behind, which after I had attained some height were seen more clearly and decidedly than I had yet noticed—the whole of the snow-covered portions of the Mont Blanc chain forming the background, while the Dent de Midi, the Dent de Morcles, and numerous others whose names I do not know, and many of which I had never seen before, stood up in bold relief in the nearer distance. The view of the plain between the Jura and the lake was also more interesting than I had expected; it had the appearance of a very flat surface abutting directly against the highly inclined sides of the mountains, and spreading between them to a great extent. In the middle of this plain is a range of hills running nearly parallel to the mountains on each side, and rising in a series of undulations as far as the eye can reach. There is an axis of disturbance accounting geologically for this appearance.

I had a most lovely night for my passage across the Jura. Long after the sun had set to me, and after it had sunk far below most of the mountains, even on the other side of the lake of Geneva, its last beams were tinging Mont Blanc with delicate pink; and when that highest elevation had again become

white, the full moon was seen just resting upon the shoulders of other mountains, its round face apparently of an enormous size, and coloured deeply with the peculiar tint with which it is usually seen when rising through distant mist. By the time I had reached the top of the pass, and began to make the turn to descend, it had risen higher and become bright, giving magnificent effect to the vast and apparently interminable pine forests, which quite filled the view, and clothed not only the terrace on which I was, but also another large and noble mountain then seen for the first time, and frowning in its solitude upon the lower heights which it commanded. The road is excellent, and being almost all downhill, is soon got over. Before long, on making a sudden turn, the forest is lost sight of, and the country becomes open and very hilly. Having picked up a couple of people who were going to the next village to that at which I was to take up my quarters, I had the advantage of their knowledge of the country, and came along a foot-path which I should not have ventured on for the first time by myself. Leaving the road, this path was immediately lost sight of in a quantity of loose stones and naked rock, and then entered a wild gorge, with the bold steep face of a hill of naked rock on each side. Although the actual elevation was not very considerable, I do not think I have ever seen anything more truly bold, wild and grand than these rocks, and they lasted for a long way in the richest confusion, till suddenly on looking down there was a change. Immediately below extended for some miles a placid lake, two or three little villages were seen shining in the bright moonlight, and marks of cultivation and the hand of man were manifested, all giving such a turn to one's previous thoughts and meditations, as only those who have seen and enjoyed similar contrasts can at all understand. Very soon afterwards I was comfortably deposited in an inn, where excellent coffee, bread, butter, and delicious honey quickly dissipated any little feeling of fatigue from my day's exertions.

The Lake of Joux is the largest of three lakes situated in a valley of the same name, and is about six miles long and one broad. The mountains rise abruptly from each bank; and on the east side particularly are very fine, and occasionally bold and romantic. The village in which I took up my night's

abode was quite at the head of the lake, and the morning after my arrival being very misty, I cannot speak with certainty about the scenery towards the other end.

Turning round to the north from this village of Le Pont, there is a path which almost immediately brings one to the foot of a very much smaller lake than that of Le Joux; presenting fine views of mountain and lake scenery on a small scale. Immediately on the right the mountains rise suddenly, arid and bleak. A little further on they begin to be clothed with forest trees and pines, and at no great distance there is a large pine forest, not only descending to the water's edge, but extending across the head of the little lake, and far down into a valley which opens beyond. On the other side the whole of the mountains are clothed with rich green; sometimes dark, and sometimes of that paler colour which denotes cultivation, and is generally accompanied by the pretty white cottage, or the little assemblage of houses forming a hamlet. Unfortunately the morning of my journeying in this valley was at first misty, but after a mile or two it was pleasant to find oneself coming out of the mist, and leaving it as a cloud behind; and still more pleasing to see the cloud gradually lift itself from the surface till it was quite lost in the thin morning air.

Leaving this valley to the south, I walked on a short distance through a sort of gorge, and then rapidly descending in a forest of pines, found myself at the head of the valley of the Orbe, one of the most beautiful of its kind in any part of Switzerland. Nothing can be finer than the wildness and grandeur in the upper part of this valley, and the contrast between this and the cultivated and quiet scenery of that part which extends beyond the town of Vallorbe towards Yverdon. A kind of road passes to this village from Le Pont, but I soon quitted it, and made my way down a very steep face of the gorge to the bed of the little river Orbe, where I was rewarded with magnificent views of the naked rocks which rise perpendicularly at the head of the valley. Soon afterwards I reached the village, which is interesting, as Swiss villages almost always are. The houses are built of wood with a staircase outside, and large galleries for shelter against the weather; the pretty wooden tiling on the houses, and the cleanliness both within and without, are always pleasing.

The valley extends for some leagues beyond this point, gradu-

ally opening out and becoming more cultivated till it is lost in the plains near Yverdon, where its river, after performing a full share of useful work by turning numerous water-wheels, terminates its course in the placid lake of Neufchâtel. Although itself very small, the Orbe is among the largest of the few streams whose united supplies keep this extensive sheet of water at its level.

After passing Vallorbe, the road crosses a range of mountains which shut in the valley, and turning up a sort of opening between two of them, I soon found myself in a rather naked, barren district, with here and there some small iron-foundries, offering no very interesting points of view. Soon, however, I arrived near the French town of Jougny, placed on the top of a rather high hill, and seen long before it is reached.

The road up to the town is very steep, and as soon as I got to the top, a soldier, who had been watching me from a little box overhanging the path, busied himself in looking at my passport, and turning over every article in my knapsack; after which he took me to the office of the chief of the police in the town, that my name might be immortalized among those persons, who like myself had been sufficiently fortunate to visit this frontier of *la grande nation.* I found the officer a rather intelligent man, and when he learnt that I was interested in such matters, he showed me some fossils, which he had found in the Jura, near Pontarlier.

He showed me also a medal of Julius Cæsar, which had been picked up in some place near. The extremely perfect state and excellent coining of this medal surpass those of any bronze I had seen, and the simplicity of the mottoes, "Julius Cæsar" on one side, and "Veni Vidi Vici" on the other, set off the simple dignity of the fine head.

The medal was to be sent to Paris, and it was interesting to find a man in this miserable town, far from any society, and in a wild country,—for this outer range of the Juras is not very picturesque,—employing his spare time in making little collections, which at all events showed a wish to improve, instead of occupying his time by smoking and doing mischief.

From Jougny I went on northwards, soon passing again into Switzerland, and travelling through wild, and occasionally even grand scenery; but during the whole afternoon's march, the only people I met were three or four charcoal-burners, bringing the produce of their labour from the forests. This melancholy waste

extends for some leagues, and only opens to a wider extent of waste, in the middle of which a large village and two smaller ones are seen amongst pine forests, through which I found no other guide than my compass and map, without which I should often have been at a loss. Without much variety or very much beauty the road winds on for some miles, till after mounting through another large forest there is a rapid descent, and as soon as the trees permit, a long narrow east and west valley is seen stretching away to the right and left at one's feet, along which a great number of houses are sprinkled in an irregular line, forming a straggling village street, which includes four villages joined in one, and called Les Verrières Suisses. Beyond in the same valley, and towards Pontarlier, is another similar little settlement, which goes by the name of the French Verrières, and in which, as well as in the Swiss, there is a good deal of manufacture going on, and not a little contraband trade.

Leaving this valley, I went still northwards, and after a night spent in an inn a little way up a mountain side, the next morning I crossed into another range of valleys, and after proceeding along the bottom for ten or twelve miles, and again mounting two or three more miles, I found myself upon an elevation looking down into the valley of Locle, over the low range of hills which crosses this valley into that of the Chaux de Fonds. The former of these, in which Locle stands, is small, but very pretty, and well cultivated. Hills surround it on all sides, and of those on the south-west, at the head of the valley, some project forwards and form little ridges, running almost to the town, which add much to the picturesque effect. There are but few trees to be seen, and the hills are almost entirely used for pasture, but I imagine there is a good deal of cultivation in the valley below.

The village of Locle is not seen until, descending from the high ground, one comes suddenly upon it. It is very large, and there are a multitude of little knots of houses in all directions and at various distances, making the environs pretty. The place itself is well built, and after a fire which took place some five years before my visit, destroying a vast number of houses, the town had been rebuilt on a much larger scale, and in much better style than before. The inns are numerous, and appear excellent; the churches are well built; but of course, in a large commercial village which has worked itself recently into importance, one could not expect much architectural beauty.

The business of watch-making, for exportation on a large scale, has long been carried on in these valleys, and it was interesting to notice, in approaching the place, that in almost every window some part of a watchmaker's apparatus might be seen, while even in the public-houses by the road-side, both men and women were sitting before the windows with their little vices screwed to benches before them, working away as if watches were the thing of all others which nobody in the world could possibly do without.

Going on from Locle the road soon crosses the hills which separate this valley from that of the Chaux de Fonds, and passing through that village continues northwards towards other smaller and less important places, as far as Noirmont, about four leagues from La Chaux de Fonds. It was quite dark long before I got here, and although I knew myself to be in the neighbourhood of houses, there was nobody about, and I could not find the inn. At length there appeared the welcome sight of a sign, and a lofty pole with a dead clump of leaves at the top, which experience had taught me had some mysterious allusion to lodging, coffee, bread, and other matters. I went in and found some people in the kitchen,—an enormous wild-looking place with a few charcoal ashes giving a dusky red light to everything; and finding that I could be accommodated for the night, I allowed myself to be ushered into the public room, where was a scene which reminded me of the interiors of Teniers.

I was on my way again about half-past seven next morning, and although rainy and miserable enough at starting, yet by the time I had got a few leagues it cleared. For some distance the road was not remarkable for beauty, but at about the fourth league I reached a summit, and saw before me the beautiful valley in which stands the village of St. Braix. Just opposite to where the road enters the valley, there is a natural escarpment of the limestone, which offers a perpendicular face, quite naked, except where here and there a few pines have planted themselves in recesses which the eye cannot perceive, and which add to the wild and picturesque appearance. Passing down into the valley, the road goes through the village, and winds along under the perpendicular rocks for a long time, till suddenly it turns to the left, into another lovely valley richly cultivated; the adjoining hills being clothed with forest trees, and little villages peeping out here and there, showing symptoms of life. Still further on and about half-way up the valley the mountains

on each side close in, and the path continues through a mere gorge, with the rocks on each side rising suddenly to a very considerable height. At one point the rocks project suddenly to some distance to meet those opposite, and it has been necessary to cut a short tunnel to allow a passage. Immediately after this the valley widens, and from presenting a spectacle of severe grandeur, becomes smiling and rich. Between this and Porrentruy there is one more fine valley, but as I passed through it while a thunder-storm was travelling in an opposite direction, I saw little of its beauty.

The valley in which Porrentruy is situated is not very extensive either in length or breadth. From the top of a low ridge crossed in entering it from the south, the eye reaches from one extremity to the other,—the little town of Porrentruy and the village of Alle, about two miles and a half distant, looking like two sentries keeping guard over the fertile hollow between them. A narrow and not very deep, but rather noisy stream runs past the village to the town; and the high road passes along its banks beneath an escarpment of limestone rocks, which have probably been brought into their present state by the long-continued action of water. Descending from the ridge into the valley towards Porrentruy, the town is seen more plainly. It appears pretty and picturesque from a distance, as it is furnished with several little round Swiss towers, with conical caps on their tops, resembling those so well known and so effective in the mountain scenery of the country. Unfortunately, as is too often the case, a further acquaintance does not improve, or even confirm, the first impressions; and the perfection of knowledge to which I afterwards attained on the subject only left the following unbiassed account in my note-book :—"It is a walled, ancient place, with streets of dirty-looking badly-built houses, with churches and market-places to match; and is surrounded by some very useless defences, which are hardly more picturesque than they would be efficacious."

CHAPTER THE SECOND.

MEETING OF THE FRENCH GEOLOGICAL SOCIETY AT PORRENTRUY.

In the town of Porrentruy, as described at the close of the last chapter, it may well be imagined that the arrival of forty or fifty persons at once would produce no slight effect. The inns were crowded; and it was only by certain judicious inquiries after eminent scientific persons, and an intimation that I desired to be *taken in* in a scientific sense, that I managed to obtain half a bedroom and a whole bed. Probably indeed my appearance was not very prepossessing, as the knapsack of walking geologists does not generally include many things that are not absolutely necessary, and I was at that time looking as little like a gentleman as an utter neglect of the elegances of the tailor, hatter, and shoemaker could make me. As soon, however, as I obtained a room and lodging, I made myself as decent as the state of my wardrobe permitted, and went from hotel to inn, and from inn to public-house, inquiring after the people I expected, and those whom I either knew or had introductions to. I soon found that none of the eminent French geologists had come, and that of those who were present all but one were engaged at a grand dinner then going on, and given to the Society by the Canton of Berne. The one exception, however, was sufficient for me; and I found in M. Morelli, of Milan, an agreeable companion, and one who could give me just the information that I required. I saw no one else that night, but retired to rest, and prepared for a geological expedition planned for the next day, the object being partly to investigate the geological structure of the neighbourhood, and partly to prepare for the solemnities of the approaching evening, when there was not only a dinner to be eaten, but a ball to attend.

According to appointment, there was a considerable muster at "The College" soon after half-past five, in spite of a driving rain, which threatened complete discomfiture to every garment short of a macintosh. The members present consisted of a

motley group from almost all nations under heaven. Besides the French, Swiss, and Germans, who seemed to be about equal in number, there was a Russian, a Belgian, an American, and (when I appeared) an Englishman; and I must say that nothing could have exceeded the perfect cordiality and friendly feeling which seemed to animate every one, without exception, and united the whole party into one joyous brotherhood, determined to find amusement and instruction in every object and every incident that presented itself.

The principal men of European reputation present were, Dr. Louis Agassiz, of Neufchâtel, decidedly the first; Professor Studer, of Berne, then a rising and very able geologist; Professor Thurman, of Porrentruy, who had written a valuable memoir on that part of the Jura range situated in the Canton of Berne; M. d'Omalius d'Halloy, the author of a work on geology, and who has studied his own country (Belgium) extremely well; and M. Œninghausen, who some years ago made an expedition to England, and published works on the geology of our south-western coast. Besides these, and M. Braun, of Carlsruhe, an excellent mineralogist, I cannot recall any names of note.

We now started upon the expedition, which was, we were told, to last till two or three o'clock, and show to us the valley of dislocation immediately south of Porrentruy, disclosing the geological series from the Portland oolite, on which the town stands, across the Kimmeridge clay, and through the Coralline oolite and Oxford clay, to the Great oolite.

Leaving the town and proceeding southwards, we began to rise gradually, and soon attained a moderate elevation, whence the chain of the Vosges in France, and the mountains of the Black Forest in Germany, formed a beautiful finish to the extensive prospect which opened upon us. I may remark here that I was astonished at the fine outline which the range of the Vosges presents, and learnt for the first time that the valleys within the chain, and the general character of the country and its inhabitants, are as interesting, and even picturesque, as the scenery which attracts so many travellers to Switzerland and Germany. But this by the way, and as a hint to future tourists in the east of France.

After a brief pause on this rising ground to collect our forces, which had been rather scattered, in consequence of a

little foraging which had gone on in a village through which we had passed, we continued to ascend till we reached the principal summit of the Portland oolite, beyond which there is a very slight descent, and a narrow and inconsiderable valley, enclosed on the other side by the lower beds of the oolite, which have here been lifted up, and form the highest part of the ridge; while in the valley itself there occurs a bed of clay, probably identifiable with our Kimmeridge clay. To explain this appearance more clearly—and it is one of the phænomena of disturbance most frequent in this part of the Jura—let the reader imagine a succession of strata, of which the three uppermost are limestone, clay, and sandstone, lifted up into a ridge by a force from below. It is not difficult to conceive, that in lifting up such a series, the edges being firmly kept down by pressure, the upper bed, not defended from above, will break, and be exposed to very rapid degradation by atmospheric causes, as soon as the effort which raised the mountain has ceased to act. Thus, after some time the broken capping of stone will be destroyed; the clay, which comes next, being soft, is easily washed away; and nothing remains but the part originally lowest, now forming a central ridge higher than the other beds. But, again, the capping of upper oolite spoken of as broken, would only be much injured within a moderate distance of the line of extreme pressure, and therefore along the sides of the hill it would be more solid, and less liable to injury. Just so we find it: we have an irregular ridge, not so high as the central one; then a valley, caused simply by the more rapid washing away of the clay than the stone beds; and lastly, in the centre, the stratum lowest in formation, highest in accidental locality. This description of one very numerous class of disturbances in all hilly countries, especially the west of Switzerland and the east of France, may be useful to those not much accustomed to geological generalizations; and it need only be added that I have here described a simple case of a "saddle" or "anticlinal axis," a word in common use amongst geologists.

It will be apparent, from all that has been said, that the inclination of the beds is exactly opposite on the two sides of the hill or ridge; for it is just as if one took sheets of paper, and bent them so that the middle should be the highest part, when the sides would shelve away like the two sides of the roof of a house, each in a different direction.

After having viewed the position of the beds and the nature of the disturbance at Monturban—or Mont Terrible, as the place is usually, but mistakenly, called—we visited a curious gorge in the oolite, extremely narrow, and walled in on each side by perpendicular rocks, which occasionally projected more or less into the gorge, and almost closed the passage through it. Then, going on, we passed a thick bed of Kimmeridge clay, and saw another singular appearance in the oolitic beds, where a sudden escarpment seemed to terminate a nearly flat table-land of the Portland rock; so that we came upon the overhanging edge of a precipice, and looked down perpendicularly more than a hundred feet, without having been aware, till the very moment of reaching the edge, of this sudden change of level.

This was a very interesting place, as well for its geology and picturesque beauty, as for the extraordinary abruptness of the escarpment. But some of our party discovered at no great distance a small house, where a substantial luncheon had been prepared. Instantly the geology and the picturesque scenery were neglected; and before many minutes were past the whole party was seated before some extempore tables, discussing with the most hearty good will a capital meal, which was not unnecessary, considering the labours we had undergone and those in prospect. As soon as appetite was satisfied, some Germans began singing choruses. Before long, songs were called for, and given in various tongues: one person danced a Tyrolese dance, accompanying himself with his own voice: the Russian danced in the manner of his country: and this scene taking place in the parlour of a little road-side public-house, with hammers, knapsacks, bags of all kinds, and other accoutrements lying about, combined to make it one of the most amusing adventures I ever had. It was truly delightful, too, to see how completely everybody threw himself into the fun of the thing, and seemed to enjoy it perfectly for its very absurdity.

After our singing was over, we marched forth again, and visited a bed of lias brought to the surface by a disturbance similar to that of Monturban, of which it almost forms a part; and when we had obtained satisfactory ideas and collected fossils at this point, we proceeded to a bed of gypsum at no great distance, and then returned to Porrentruy by some carriages which had been ordered to attend us, and which we found at a neigh-

bouring village. By this time the weather had cleared, and only the beginning and ending of our walk were rainy.

As we arrived at our hotel by about half-past three, and were not to dine till five, we had time to make our toilets, and prepare for a grand dinner given by the town in our honour, and followed by a ball. The dinner was by no means first-rate—indeed, I have the authority of French and German, Russian and Italian, Swiss and American, for calling it, as it really was, execrable. I am almost sorry to put it on record, the thing was done with such hearty good will; but the fact is undeniable. I should not forget, however, the giant of the table—a huge trout, nearly three feet long, brought in on a board because no dish could hold it, and as unfit to eat as it was extraordinary to look at. After dinner we were regaled with a geological dessert, consisting of *sucrifactions* of terebratulæ and other shells; of a model in sugar of the Mont Terrible, or some other Jura mountain; and last, not least, of a number of real ammonites and terebratulæ, put up in paper, with crackers; showing a fine example of the connexion of the physical sciences in thus enlarging the mind of the maker of bon-bons, while the philosopher with no less astonishment found a fossil where he had been accustomed to look for barley-sugar. After dinner and two or three toasts—the dinner having lasted three hours—most part of the company joined the ladies above, where dancing had already commenced. The ladies were —as ladies always must be—charming, and as there was a pretty sprinkling of Germans and one Pole, there was no lack of variety; but, however difficult, I must neglect them, that a line or two may be devoted to the dresses of the gentlemen. Among our number there were a very few who had come provided for such emergences; and one especially, a handsome young exquisite from Paris, was attired in the very pink of fashion, with hair covering about four-fifths of his face, and gold and jewels about as large a proportion of his waistcoat. Contrasted with these was the dress of the rest of us, which may be thus described:— Coat with or without tails, and adapted in various ways for walking, but not for dancing; waistcoat nothing extraordinary; trowsers all colours but black; and the feet covered with thick boots, or high walking shoes. This being our condition with regard to appearance, the dances of all kinds, waltzes, gallopades, and contre-dances, were kept up notwithstanding with great

spirit till a late hour. A very short time was allowed for rest after these exertions; since at half-past three the next morning we were again disturbed, that we might be ready to depart at four on a second and longer expedition, and one which seemed to be the chief object of the meeting. Accordingly, before daylight there was to be seen, in the "salle à manger" of the principal hotel, the whole assembly of savans, deeply engaged in the discussion of coffee; and outside the house a corresponding train of carriages, each with one or more animals attached. Before very long, and after some clamouring to obtain every vehicle of any kind in the place, we were all packed somehow or other, and proceeded on our way. The carriages were extraordinary: some resembled cabs, others looked more like carts: and there was one of a kind which every one who has been in Switzerland must remember, with the seat sideways, and so ingeniously contrived, that, under ordinary circumstances, the whole beauty of a district may be passed by without giving the traveller the trouble even of admiring it. When we were all deposited, we proceeded at a moderate pace for an hour or two, when we stopped to walk up a hill where the coralline oolite was exceedingly well exposed on the surface of some highly inclined beds. There was here, also, a proof of the slow deposit of the limestone. One of the most plentiful fossils in these beds is a species of Spatangus, of which numerous specimens, some extremely large, might be observed along the exposed surface of the bed, but always in the same position as they had lived and died, presenting to view either the lower side or the mere impression of the upper surface, but nowhere exposing any portion of the convex part of the shell. It is clear that the bed has been formed gradually round the shell, while the latter was resting quietly at the bottom of the ocean. When we had passed this spot, a turn of the road presented a most interesting prospect. Just before us, looking north-east, a conical hill rose finely and boldly from a group of other hills which formed an amphitheatre around it; and while this amphitheatre was richly wooded with forest trees, there was also a perpendicular escarpment exposing a synclinal axis in the conical hill, leaving bare a succession of terraces of coralline and Portland oolite, which met at an obtuse angle in the natural section of the beds.

Between this point and the town of Délémont the road is

pretty, but not remarkable; but beyond that town we went for a short distance down the valley of the Byrse, which all who have travelled between Berne and Bâle must remember as amongst the most beautiful of the Swiss valleys. The river, indeed, passes through deep cuts in the mountains which border it, not only beyond Délémont, but also more to the south, between Moutier and Courrendlin; and after passing the latter town, it crosses a wide tertiary valley for some miles to Délémont, and then almost immediately becomes shut in, romantic rocks rising suddenly on each side to a considerable height. On these stood formerly strong castles; one on the west was built by the Romans to overawe another on the east, which the early inhabitants of the country had erected for their defence, but of which all traces are now lost. One tower of Roman work still remains, and a chapel stands before it, also extremely ancient, and perched on the very pinnacle of the rock; so that, when seen from below, one can hardly fancy that there is sufficient room even for the foundations of the building. This chapel, so romantically placed, is as curious in its interior as in its situation and appearance. It contains two or three paintings, in a style resembling that of the early Flemish school; and one of them said to be as much as eight centuries old. These are in the chancel; and the other walls of the church are covered with more than a hundred of the most extraordinary and even ludicrous pictures, left there "ex voto"—that is, in consequence of vows made by sick people, and for friends in distress. It is utterly impossible to conceive anything more truly absurd: the perspective is worthy of a Chinese artist, but the faces and dresses are essentially European; and the funny-looking children in squabby Dutch petticoats, contrasted with their papas in bright blue coats, with gilt buttons and very short square coat-tails, and mammas in all the magnificence of wide frills and gay colours, are inexpressibly droll. The view from a cross just outside the chapel is very extensive and interesting, as it commands not only the whole length of the gorge through which the river runs, but also the longitudinal valley which it is just leaving. There are not wanting in the distance, ancient ruined castles and village spires, to add the interest which man could contribute. I should not forget to mention that we were here received by a deputation from Délémont, and requested to partake of a very handsome

déjeûner à la fourchette, to which, I believe, we all did ample justice. After leaving the chapel we descended to a place where a pisolitic iron of the oolite formation is so plentiful as to be worth working in considerable quantities, and then proceeding on our journey, we crossed the tertiary valley already alluded to, and soon entered the gorge extending from Moutier to Courrendlin. I had not seen anything in Switzerland more extraordinary than this; and although I have since visited most parts of the country, yet, looking with the eye of a geologist as well as a traveller, I must still say that it retains its great interest. To describe it is difficult, as a great part of the effect is produced by the incessant shifting and changing of the scenery. Both the entrance to and exit from the gorge are quite sudden. In coming to it from Délémont we quit the open country, and in one moment find ourselves among bare, rugged rocks, rising perpendicularly on either side, presenting the most grotesque appearances, and giving natural sections of beds apparently inclined so variably, that the mind is bewildered in attempting to follow the disarrangement, and trace order in such confusion. Anticlinal and synclinal axes here follow so rapidly, that all idea of counting their number is out of the question. At length, however, they cease, and there is the mark of a violent disruption; the beds are first perpendicular, and then, within a hundred yards, they bend rapidly, until, at the top of the high exposed cliff, they are perfectly horizontal. So sudden a bend of rocks, which are now hard and very brittle, I had nowhere else seen. After this the valley widens for a short distance, and is then almost closed in by two walls of rock, projecting to meet each other on the opposite sides of the river. These walls are, perhaps, eighteen or twenty feet thick, and three or four hundred feet high, and they project not less than twenty yards from the general line of the rock on each side. Not far off there is a spring of petrifying water, whose source is hidden among the luxuriant vegetation, and the water drops from the leaves and extremities of the branches in a constant stream, encrusting with stone every substance upon which it falls. So large a quantity of calcareous matter has thus been deposited, that the petrifactions are dug out and carried to a distance, to be used as a building-stone after time has hardened the composition. Soon after leaving these weeping trees, and coming out of the gorge towards Moutier, the

tertiary sandstone called Molasse is seen on the road-side, and continues southward. Our course, however, lay rather to the east, and we reached the Weissenstein the same evening, just in time to be witness of a most magnificent storm, but too late to enjoy the very extensive prospect, which, in fine weather, makes this place much resorted to by travellers in Switzerland.

The next morning we left our elevated quarters on the mountain rather early, without seeing more than the clouds far below us. Going first to an adjacent mountain, rather higher, we almost directly descended upon a remarkably interesting secondary valley, in which were presented the whole series of the Jura oolites, down to the muschelkalk. I may remark here, that the effects of the various causes formerly in operation, tending to modify rocks by mechanical agency, are seldom to be observed so well as in the valleys of the Jura, the eastern ones more particularly. All seems as fresh as if the disturbances had taken place yesterday, and one can see the jagged and naked rock at the head of a valley, melting quietly down into a regular hill-side, and terminating in merely undulating ground at the opening of the valley, with all the distinctness of a work of yesterday. I need not say how much the interest of geology is increased in such a district, and how many difficulties, or things which seem to be difficulties, are here cleared up before the light of nature and truth.

Working our way now towards Solothurn, or Soleure, we came into the valley of the Aar, where the rocks are entirely secondary. The city of Soleure stands upon the Aar; but although containing much to interest and amuse, we had not time to dwell long upon its beauties and wonders. I will mention only the museum, in which there is collected a remarkably fine series of fossil Tortoises and Turtles, obtained from various parts of the Jura oolites. These consist not only of portions of the carapace, but also of bones and teeth, and are in great abundance, and extraordinarily perfect. Besides them, there are many other bones from the same formation, and a few teeth, which, in all probability, must be referred to some of the extinct reptilian monsters of larger size.

When we had seen all the wonders of the town—and I should not omit to say that the Prefect and other authorities waited upon us and showed us everything—we partook of a magnificent cold

collation, to which nearly a hundred people sat down, and then proceeded on our way, and towards ten o'clock arrived in the neighbourhood of Bienne, which was the next point of attraction. At about a mile from the town, we found a deputation waiting our arrival, and having descended from our carriages, we listened, with heads uncovered and faces composed into the most decent gravity, while a short, puffy, important little man, with a proportionate voice, was haranguing us on the honour done to Bienne by our visit, and the delight which its inhabitants felt, in common with all the Swiss, at the opportunity of showing their feelings of veneration for the French *savans*, especially those who studied that science—of all others the most interesting—to which the society present had devoted itself. Having had a happy delivery of his speech, and thereby lightened his mind greatly, the little man listened with vast gravity, while our pro-vice-president made a fine flaming oration in the same style; and then, after much bowing, we put on our hats, jumped into the carriages, and made the best of our way onward: but our honours were not yet fully blown. Before we had got much more than half a mile, or were within sight of the town, we heard salutes firing: our modesty at first refused to believe that it was intended so to exalt us; but as we approached the firing continued, and we soon saw that we were to enter in triumph. The whole military and civil force was, in fact, drawn out to meet us, and we were ushered into the town amid such a beating of drums, playing of music, waving of flags, and shouting of voices, that strangers would have thought that at least half-a-dozen kings were making their entry, and not that the view of our geological faces and hammers was the sole attraction. We dismounted at the principal inn, and were received by all the chief people of the place, who informed us that they expected the honour of our company to dinnner. Such an offer could not be refused, and we agreed so far to change our plans as to sleep at Bienne, and proceed next morning on the lake to Neuveville, where we had made arrangements to take up our quarters, and where, it turned out afterwards, we had been anxiously expected, and the town was to have been illuminated for our amusement.

However, we stopped at Bienne, and thence made a short excursion round the town, to look at some large boulders of granite, gneiss, and porphyry, which are very numerous on the mountains

behind the town, and were interesting when taken in connexion with certain flat, polished spots, on the face of the Jura oolite, upon which they were lying. From Bienne, next morning, we went by the lake to Neuveville, at least some took water, but many preferred walking, as the weather was extremely unfavourable, and there was every appearance of a thoroughly wet day. Notwithstanding the rain, however, all agreed that we ought not to omit visiting the little island St. Pierre—so celebrated as the abode of Jean Jacques Rousseau—and we were put ashore there, but, alas! to very little purpose, as we could neither enjoy the beauties of the island, nor see any of the prospects which make it so charming a residence. For want, I suppose, of out-of-door work, the society held a meeting in the bedroom of the Frenchman's idol, some of the members sitting on three chairs, with which the room was furnished, some on the table, others on the floor, and the rest, of whom I was one, on the very bed on which he had slept. After our "séance" we took boat, and soon found ourselves approaching Neuveville, the information being given by the salutes which were fired, rather than by any view which the heavy and incessant rain permitted us to have of the place.

We could not, of course, do much under such circumstances, but resolved not to be beaten. We went to see an example of polished rock in the vicinity, and then returned, dined, and made our way back to Bienne in the evening, as wet, cold, and miserable as could well be. Next morning at half-past eight I was quietly breakfasting at Berne, my geological trip and the meeting of the society both concluded.

The chief business done at the meeting was the discussion of the great glacier question, then just promulgated by Professor Agassiz, who had recently been examining the streams of ice encroaching on the valleys in some parts of Switzerland and retiring in others, and comparing the marks undoubtedly produced in this way with similar appearances on the Jura mountains. Striated and polished rocks were before long looked for and found in almost every mountain district throughout Europe, and various English geologists advocated strongly the views of glacial action suggested. Since then, a whole department of tertiary geology has arisen out of the full consideration of the subject, and ice, whether driven down a valley by the weight of a vast superincumbent mass of snow and frozen gravel, or drifted across a sea

by a marine current, has been recognised as an agent of change to an extent which would before have been thought altogether unreasonable. It was, perhaps, not without some effect on the movement, then in its infancy, that M. Agassiz had an opportunity of illustrating and explaining his views on this occasion on the flanks of the Jura, and hearing those objections which naturally suggested themselves to the intelligent and distinguished geologists present. In this way, the views themselves were rendered less vague, and the discussion of them was fairly and openly commenced.

Whatever may have been the other benefits accruing to science from this meeting, which did not at the time appear to have been so successful as usual, one thing is perfectly clear, namely the use of such opportunities for those working in different fields of science to meet together on common ground. If only for the sake of the discussions and private conversations of the members, there is great benefit from such assemblies; and I may add, that I parted from the numerous acquaintances I formed at Porrentruy, with feelings of satisfaction at having passed a most agreeable week, and with regret that a long time might elapse before I again fell in with so united and friendly a party.

It has not been my object in this and the following sketch to give any account of the formal communications made at the meetings, or describe the actual results in any scientific matters discussed. No doubt there was an absence of great discoveries, or brilliant and new views in important questions of philosophy, nor are such at all necessary for success. What there was, and what is most useful, amounts to no more than pleasant social intercourse between strangers of similar pursuits,—an intercommunication of ideas in the case of people following the same profession in distant places, the renewal of old acquaintanceship amongst some who had long been parted, and the general benefit derived by change of scene and lively society, in the case of men of sedentary lives, or those confined by circumstances to move round constantly in the same track.

GERMANY

PYRMONT, AND THE GERMAN NATURALISTS' MEETING.

GERMANY.

PYRMONT, AND A MEETING OF GERMAN NATURALISTS.

In the year 1839, I was present at one of the meetings of the German Association of Naturalists and Physicians, held at Pyrmont, in Northern Germany. This association may almost be regarded as the parent of our own British Association for the Advancement of Science, and of most of the continental meetings having similar objects. It was, however, originally commenced, more with a view to bring together medical men of some scientific attainments, and assist them in intercommunication, than to take up general subjects of pure science or philosophical natural history. I do not remember when or where the first meeting took place, but there had been a great many before the one here described. The meetings were not, at the time I speak of, very numerously attended, and a foreigner was a rare occurrence, so that although my pretensions to rank as a *savant* were then exceedingly small, and my knowledge of German only of one summer's growth, I was received with more than civility, and being the only Englishman present, was expected to take a position which I was certainly not very competent to do justice to. Thanks to introductions and recommendations from kind friends at Cambridge, I was soon made at home, and had every opportunity of seeing and doing everything. I need hardly say that I took such advantage as I was able of these opportunities.

I arrived at Pyrmont on the evening of the second day of the meeting. The town is prettily situated in the romantic valley of the Emmer, on sandstones of the triassic period, and is surrounded on all sides by muschelkalk hills of moderate elevation. It is the capital of a little state belonging to the Prince of Waldeck, only about thirty-five square miles in extent, and with a population of 6000 inhabitants. The town is tolerably well built, small, neat, and dull. On my arrival I was

immediately provided with a lodging in the house of one of the inhabitants, who, with many others, had most liberally and hospitably allowed the committee to quarter the members of the Association and visitors upon them, thus indicating in the most satisfactory manner the interest they took in the proceedings of the meeting. Once established in a comfortable home, I lost no time in making inquiries as to the most interesting and remarkable of the German naturalists who were present for the week. I found that there were about 200 persons announced, several of them being men of great note in the scientific world. Amongst them was Von Buch and A. Rose, of Berlin; M. von Roemer, the author of some known geological works; M. Kaup, of Darmstadt, to whom we are indebted for the first accounts of the Dinotherium; the well-known Count von Münster, of Baireuth; M. von Dechen, author of a well-known geological map of central Europe; Professor Nöggerath, of Bonn, and several other men of European reputation; but on the whole, owing to the absence of many who had formerly been present on similar occasions, the meeting was regarded as rather poorly attended. The usual reasons for absence were given, such as the length of the journey and want of time, and in many cases such excuses were doubtless valid.

The meetings, as with us, were of two kinds, various committees discussing and despatching purely scientific matters, and general business being entertained by the whole assemblage of members. Occasionally excursions to view interesting natural phænomena took the place of meetings in rooms, and agreeably diversified the business in hand. At Pyrmont the accommodation for the committees was very small, and the sections accordingly met at different hours in the same room, between eight and twelve. Shortly after one o'clock, the important event of the day, dinner, required all the attention of the members. The morning scientific discussions were interesting, and conducted with good temper and sense, but there was no striking novelty either in the facts brought forward, or in deductions from them.

Eating is an accomplishment by no means confined to England or the English, and we Anglo-Saxons are not the only people amongst whom it is impossible to transact important business, or bring any work to a conclusion, without a dinner.

Great dinners and long dinners—dinners at which much is eaten and little said—occur in various places on the continent; and if occasionally there is a little more noise and clanging of glasses than with us, the main solemnities are the same in France and Germany, in Switzerland, in Italy, and everywhere else where the science of eating has been carried to any degree of perfection. On the present occasion the dinner, commencing, as I have said, at one, was brought to a conclusion some time after three, and from that time to five the gentlemen smoked, and the ladies knitted, sitting in the open air, in imperturbable silence, interrupted only at intervals, measured, it would seem, by the duration of a pipe, by a band of music stationed near. At six the company retired from the shelter of the trees under which the time since dinner had been spent, and in the evening at eight met again in the public room, where the labours of the day were brought to a close by an unceasing devotion to the waltz.

I have said that occasional excursions as well as general meetings broke the monotony of the morning assemblies of the committees or sections. The latter were of course devoted to details, but at the general meetings reports on the state and progress of various departments of science were read by the more eminent members. Of these, an account of the existing state of science in Europe, by M. von Buch, and another on the progress of geology, by Von Dechen, were quite worthy of the high reputation of their respective authors. Other similar *résumés* were communicated, and on the whole much interest was evidently taken in this part of the labours of the society, and the meeting-room, though large, was quite crowded during the whole of the time.

The excursions were something like those made by the members of our own British Association, in their periodical assemblies at different towns in the three kingdoms, but the number of members present was not so large as to render a division of the forces desirable. On one occasion we went to visit the different natural curiosities around the town, which are interesting to the geologist as well as the physician and naturalist, owing to the remarkable springs of cold mineral water that have rendered the neighbourhood so widely known, and the abundance of carbonic acid everywhere proceeding from crevices in the earth. Near the town is a castle of some interest historically, and picturesque in its ruins. About it are well-wooded, undulating

grounds, with numerous walks both to and through them. Amongst the establishments is a bottling-place for the Pyrmont water, which is largely exported; and near the spring which supplies this place is an interesting little cavern called the Dünst-hohle, from the floor of which carbonic acid gas constantly rises and produces an atmosphere sufficiently poisonous to kill small animals, such as dogs and cats, when to gratify the curiosity of visitors, the experiment of the *Grotto del Cane* of Naples is tried upon such victims. More commonly, however, it is thought sufficient to extinguish lighted torches or candles, by dipping them into the gas, to illustrate the peculiar condition of the air.

The number of points of eruption of carbonic acid gas and of water impregnated with it in the immediate environs of Pyrmont is extremely remarkable, but the variety of mineral contents of the water is hardly less singular. Thus, within 600 paces of the principal spring at New Pyrmont, all the waters are mineralized, and there are in all no less than twelve different kinds, some chiefly abounding in carbonate of lime, others in sulphate of lime, others in sulphate of magnesia, others again having large quantities of common salt, while one contains chloride of magnesium in large proportion. Most of them are of much higher specific gravity than common water; some contain enormous volumes of carbonic acid, some are intensely and permanently cold, of the most perfect transparency and sparkling brightness, while others are warm, thick and muddy. It is rarely that within so small a distance so great a variety of condition is observed, and this without any immediate vicinity of those rocks which are usually regarded as most influential in producing results of the kind, though not without geological peculiarities of structure to account for the unusual conditions of the springs. Some idea may be formed of the nature of the water, when I state that in one of the salt springs upwards of 142 grains of salts, chiefly common salt, have been obtained from a pound weight of water; while, in the case of another, a larger experiment has yielded from the evaporation of twenty-five pounds weight of water as much as 3996 grains (more than nine ounces) of common salt alone (nearly 160 grains to the pint of water), without reckoning other mineral substances*.

* The contents of three of the principal springs are given at the end of

In addition to such ingredients, iron is found to exist in most of the waters, with small but variable quantities of soda, potash, lithia, strontian, manganese, and various phosphates, chlorides and sulphates. The volume of the gases, chiefly carbonic acid, is unusually large, and the effect of the highly carbonized waters is exhilarating and stimulant to a degree I have nowhere else observed.

It may well be supposed that waters thus abounding with mineral matters produce some effect on the system when taken internally, or used for bathing. Pyrmont has long been celebrated in this respect among the German baths, and the investigation of various questions, as well medical as purely scientific, was naturally suggested by the phænomena of nature around.

In addition to such investigations in the immediate vicinity of the town, more distant excursions were arranged for, the most interesting of which involved a journey of about fifteen miles, to the baths of Meinberg and the rock of Externstein. For this, and a collation at the Kur-haus, or public saloon, an invitation had been given by the Prince of Lippe Dettmold, in whose state the baths are situated. The number of guests was of course limited, but far exceeded the accommodation which Pyrmont and the surrounding villages could produce in the way of carriages. Accordingly, after every two- and four-wheeled vehicle of the ordinary kind had been appropriated, recourse was had to the common farm wagons of the country, which were as primitive as can well be imagined, consisting only of three rough planks fitted together with a very simple framework, the whole being elevated on wheels without the intervention of springs, and having any required number of cart horses attached. Under the name of omnibuses, three such vehicles were fitted with seats, and sixteen people packed into each. The procession then, consisting of the most curious and miscellaneous assemblage of coaches, calèches, britschkas, char-à-bancs, shandaradans, cabriolets, cars, and every other imaginable variety of carriage, in such a state of dilapidation that no hackney coachman or cab-

this chapter (see p. 80). The so-called 'Soolquelle'—a brine spring—is that referred to above, and according to an analysis by Westrumb, the pound of water contains about 112 grains of common salt, 13 of sulphate of lime, and 10 of chloride of magnesium, besides carbonate of lime, sulphate of lime, and a little iron.

man in England would have deigned to look at them, and all of the most remote antiquity, closed by the three omnibuses as above described, started off at a most funereal pace, through heavy rain, at about seven o'clock in the morning. By eleven we reached Meinberg, our first destination, celebrated for its mud baths. We found it to be a small village prettily situated, and containing one government establishment for visitors, provided with conveniences for the sick.

The healing source in this place is more effective than enticing. The mud, moistened by natural springs, is found to be impregnated with a considerable quantity of sulphuretted hydrogen gas, emitting an odour, compared with which rotten eggs, or the washings of foul gun-barrels, may be considered endurable, if not pleasant. The mud having a consistence of soft clay, is introduced into the baths, and there heated by steam to a temperature of 80°, in which state the patient plunges or rather pushes himself, and pig- or elephant-like wallows there until he is ordered to be extracted.

When the whole party had visited the baths, and examined the interesting conditions under which they were administered, and had also investigated some other curious matters connected with mineral waters, they proceeded to the public room in the Kurhaus, where the Prince had provided a banquet which was really superb. When full justice had been done to this déjeûner, and the party was in a condition to start again upon its travels, the weather had cleared up, and we proceeded to Externstein in order to see and examine into some isolated blocks of sandstone jutting out in a singular and highly picturesque manner from the sandstone rock there coming to an end as an abrupt cliff. These blocks are weathered in a very singular manner, and have all the appearance of an ancient sea-cliff with projecting islands, something after the manner of the Needles of the Isle of Wight, or the similar columnar masses of chalk near Flamborough Head. The action of the atmosphere, and the various degrees of hardness of different parts of the stone acting upon a material very easily modified in its form, have however produced an effect more like that seen on the Elbe, near Dresden, the columns being lofty, rounded, very nearly perfect in some cases, and very numerous. The intervals also between them are so small that bridges have been constructed, communicating from one to another, and stair-

cases cut to enable the visitor to ascend to the summit. The view from the top is extensive and very striking. The eye ranges over a wide, undulating ground, for the most part richly cultivated, with a silver thread of water running along through it; the ground is broken and the distance hilly and wooded. To the German, this spot abounds with historical reminiscences of rare interest, for here was fought the celebrated *Herman-schlacht*, the battle which took place between Arminius (Herman), one of the greatest of the Teutonic heroes, and Germanicus, the son of Drusus, who commanded the Roman army in Westphalia, and was defeated in this place about the close of the first century of the Christian era. Numerous remains of this great battle have been found in the neighbourhood, and a gigantic bronze statue of the national demi-god, seventy-four feet high, has been recently erected with great state in a prominent part of the field, within sight of the singular broken promontory above described. At the time of our visit, the work was progressing at Lemeo (between Pyrmont and Herford), and was partly completed.

On one of the larger outliers of this picturesque group, a band of music was stationed, and the effect was exceedingly curious, owing to the great height of the performers above the audience. Here the company assembled and partook of coffee, which had been provided by some hospitable hosts, and after strolling about and enjoying the beauties of the weather and scenery for a time, the procession was re-formed, and returned to Pyrmont, everybody being in the highest spirits, singing and shouting at the utmost pitch of their voices; the sky perfectly clear, the moon near the full, and the country beautifully wooded and picturesque.

The day after this expedition, a general meeting was held of the various sections, and some interesting papers were communicated. Ladies were present and exhibited a fair amount of interest in the proceedings, which then terminated for the year.

From Pyrmont I went by Lemeo and Herford to Bielefeld, and so to Düsseldorf. At that time the journey was rather long and tedious, but I have since gone over part of the same ground by the railroad, and find things already much changed. The country is, however, not remarkable for beauty, nor is there much that is generally interesting.

I append the results of some analyses of three of the principal

springs of Pyrmont, showing the number of grains of various ingredients in a pound of sixteen ounces.

CONTENTS OF SOME OF THE PYRMONT WATERS.

	Chalybeate Spring (1). Grains.	Bubbling Spring (2). Grains.	Saline Spring (3). Grains.
Sulphate of soda	2·5280	3·7000	11·5530
—— magnesia	4·2077	4·9347	——
—— lime	7·3870	6·8753	5·6113
—— strontian	0·0213	trace	trace
—— baryta	0·0015	trace	——
—— lithia	0·0050	trace	0·0870
Chloride of sodium	0·6764	1·7500	67·1453
—— magnesium	0·9304	1·2539	7·1986
—— lime	——	——	2·8400
Carbonate of soda	4·2668	4·5240	5·7515
—— magnesia	1·0555	0·5487	5·9200
—— lime	5·3056	5·2850	5·8266
—— oxide of iron	0·7557	0·6881	0·0650
—— oxide of manganese	0·0295	trace	trace
Phosphate of soda	——	——	trace
—— lime	trace	trace	trace
—— alumina	0·0147	——	trace
Resinous matter	0·1055	0·1267	0·1334
Alumina	——	——	0·7600
Silica	0·2292	0·2667	——
Total grains per lb.	27·5198	29·9531	112·8917

(1) This is the principal spring. The temperature is 56·7° Fahr. Specific gravity 1·004. The figures give the mean of four analyses.

(2) So called in consequence of an enormous liberation of carbonic acid gas from the water in the spring. The temperature is the same as the other. Specific gravity rather higher, being 1·0042. Mean of three analyses.

(3) This is the principal saline spring used for drinking. Temperature 54½° Fahr. Specific gravity 1·0115. Mean of three analyses. Bromine has also been detected.

SPAIN.

I. THE PYRENEES AND THE VALLEY OF THE EBRO.

II. TARRAGONA AND VALENCIA—THE COUNTRY AND TOWNS ON THE EAST COAST.

III. MADRID AND ITS MUSEUMS OF SCIENCE AND ART.

IV. CENTRAL PLATEAU AND NATURAL PASSES OF SPAIN. A VISIT TO GRANADA AND THE ALHAMBRA.

V. THE VALLEY OF THE ALPUJARRAS—THE LAST RESORT OF THE MOORS IN EUROPE.

SPAIN.

CHAPTER THE FIRST.

THE PYRÆNEES AND THE VALLEY OF THE EBRO.

NOTWITHSTANDING all that has been said and written about the Peninsula by English and French travellers, Spain still remains a country into which the tourist rarely ventures, except perhaps for a brief and hurried glimpse. Its people are not often seen away from their own land: the products of the Peninsula, although widely enough distributed in the way of raisins, wine, and lead, hardly remind one of the place whence they come: its physical features, though highly interesting, are seldom alluded to, even in the accounts of travellers; and thus a part of Europe, beyond all comparison the most strikingly original in all those points to which the attention of the thinking traveller is turned; which is very approachable, and might easily be much more so, is either altogether passed by, or is noticed only for its historical associations and its battle-fields.

True it is that these associations are of great interest, and that they minister greatly to the glory of the English name. But I had long fancied that there must be other things than battle-fields to be seen, even in a very rapid transit through the country, and I had looked forward with extreme interest to a few spare weeks, when I could obtain a general impression of its grand physical geography,—its almost subtropical vegetation,—its peculiar mountain ranges,—its yet more striking river-courses, and its singular people. I have thought that my first impressions of such matters might excite interest in many, who have greater leisure, and who will perhaps follow my example, when they know how easy it is to examine for themselves the conditions of the country and people. I have also been willing to put down, for the benefit of those whom such remarks may interest,

my views of the former and present development of the arts and sciences in Spain, as far as these subjects came under my observation. Subsequent visits to the country have only tended to confirm my first impressions.

The way in which the Spaniards chiefly succeeded in producing a great effect on civilization in Europe, was by the commanding influence of a few men of great genius in several departments of literature and art. The remarks of the passing traveller on these, as well as on the people, may be permitted, even if they are not strictly founded on technical knowledge. I do not, however, claim more than to be treated as a rapid sketcher of those facts and phænomena that fell under my observation, and what I have done, any one with a few weeks at his disposal, and a wish and determination to examine for himself, may do likewise. With these few prefatory remarks, I enter at once upon the subject before me.

I entered Spain from France by way of Perpignan and Gerona, and for the benefit of doubting and comfort-loving travellers, I may say that I was accompanied throughout my travels on one occasion by my wife, who made no extraordinary complaints of want of accommodation, or of the absence of any of the necessities of female existence, except indeed occasionally when bonnets required re-arranging, or dresses refitting. The Spaniards have, it seems, borrowed or smuggled the fashions from their French neighbours, but do not appear to have imported at the same time much of the good taste which has generally instigated these personal adornments. Although, however, ladies can certainly travel without discomfort on the high roads in Spain, and from one great town to another, I can hardly recommend them to follow exactly in my steps, when I had occasion to visit less known districts, on matters connected with my own department of scientific employment.

Perpignan is a picturesque fortified town, with narrow winding streets, few windows in the houses towards the streets, mats and curtains suspended before most of these few, small courts to most of the houses, and wooden balconies decorating both the insides of the courts and the streets. Most of the buildings are Spanish, and numerous signs both of Spanish and Moorish taste, tell the traveller at once that he is leaving behind him the climate and customs of northern Europe, and approaching both

a warmer and more characteristic and unchanging race. The cathedral and churches are dark, and richly decorated in the Spanish style. The building called La Loge, now a coffee-house, but formerly a bazaar, is a fine specimen of mixed Moorish and Gothic architecture, and exhibits a great amount both of light elegant decoration and solidity of construction. The façade resembles the most florid Gothic style, but is flat, and wants Gothic effect. The interior, on the other hand, is clustered, elegant and solid, and is extremely pleasing.

At Perpignan the passports of travellers entering Spain require the *visa* both of the French and Spanish local authorities. This costs a little both of time and money, but is not very troublesome to a careful traveller, and is a form that cannot be dispensed with. Indeed, only a few days before our arrival, a large German family, travelling post, had been turned back from the frontier, owing to the absence of the necessary signatures. The Spaniard has little consideration for any one, when requisite formalities are neglected.

There are two or three very tolerable inns at Perpignan. We selected that of the Petit Paris, and had no reason to complain, although our hotel was very different indeed from any that are found in ordinary French towns. It had but little frontage, and that very unpretending. Entered by a porte-cochère a small open court is seen, occupied during the day partly as a coach-house and partly as a dining-room for the domestics, but at night turned into a sleeping apartment for the porter and his family, with the smallest possible amount of extra accommodation. As we departed very early in the morning, we had to disturb their rest, the bed being placed before the outer gate. The stairs and some wooden galleries were round the outside of the house within the court, and all the rooms appeared to open into each other, without passages. To reach our room we had to traverse the sitting-room of the host and another small apartment, and we found in the morning that these apartments were both used as bedrooms.

The inhabitants of Perpignan are a fine mixed race, with dark complexion and dark eyes, well-grown, lively, pleasant, and conversable. They speak a very mixed patois, which is much more Spanish than French.

Leaving the town early on a fine summer morning, the road

continued for some time longer to traverse the gravel-covered plains of Roussillon, approaching gradually the Pyrenean range, which becomes both more picturesque and more characteristic, without, however, assuming any grandeur. At about fourteen miles from Perpignan, the last French town (Boulon) is passed, and immediately afterwards the Tech is crossed, and the road begins to ascend by a series of zigzags towards the Col de Pertus. A small suspension-bridge across the Tech has two piers, constructed of handsome brecciated marble, and thus affords an intimation of the characteristic mineral wealth of the adjoining mountains. The road rises continually from this point, and after passing the fortress of Bellegarde crosses the frontier of Spain, and soon reaches La Junquiera, the first Spanish town.

The view of the Pyrenees from near Boulon, where the Tech is crossed, is not without considerable interest. We are here close to the eastern extremity of the mountain range, where it gradually lowers towards the sea, and passes into the French chain of the Cevennes. At this part the breadth of mountain land is not more than twenty miles, and with the exception of Canigou, a peak of upwards of 9000 feet, the elevations are inconsiderable. But the character of the chain is well shown. The features are distinctly mountainous, though the ground is covered with rich vegetation. There is even here that wall-like abruptness, which more towards the centre becomes so exceedingly striking, and the vegetation also soon begins to indicate a change of climate: the road-side scenery is cheerful, the broken ground covered with numerous flowering shrubs of various colours, and the partly stripped trunks of the cork-trees mingle wildly but picturesquely with the other trees and shrubs. Bellegarde itself is near the highest part of the pass, which is less picturesque than the entrance of the mountains from Boulon.

The Pyrenean chain begins to rise above the sea abruptly at Cape Creus, near Roses, on the Mediterranean, almost immediately attaining an elevation of from 1500 to 2000 feet; and at the Col de Pertus, the only carriage-road on the eastern side, they undergo a small depression before rising rapidly towards the lofty peak of Canigou, at a distance of about twenty-five miles further west. For some distance the mountains are rounded, the summits consisting of plateaux, and covered

with pastures and forest. The passes, of which there are very few, are rather paths and roads across this table-land, than depressions in the main chain. Beyond Canigou the outline becomes abrupt and jagged, putting on the somewhat repulsive features which render the chain so striking and so difficult to traverse, the passes being rarely less than 5000 feet high, and by no means easy of access. The eastern extremity of the range has no mountain lakes, and does not rise above the limit of perpetual snow.

The valleys of the Pyrenees are for the most part transverse, deep, and very unapproachable. On the French side they are generally the beds of mountain torrents, and in the central districts are often covered more or less by glaciers. On the Spanish side the mountains are usually more abrupt, the valleys less watered by streams, the slopes less covered with wood, and the small lakes or ponds occasionally found on the French summits, less frequently to be seen. The rock in this part of the Pyrenees is chiefly granite, but the small flanking ridge consists of schistose and altered rocks of the Silurian period.

The frontier is passed soon after leaving the castle of Bellegarde, which stands picturesquely on a lofty insulated mountain, and defends the defile on the French side. An early and most significant indication of Spain is at once perceived in the state of the roads, which in France are generally excellent, but in Spain almost always bad, frequently altogether neglected, and as detestable as can be imagined. The transition, however, is not here so great as might be, as the road to the foot of the mountains is tolerable, and about three miles from the head of the pass we descend to the small town of La Junquiera, situated at the entrance of a plain formerly covered with rushes (*Juncus maritimus*), whence its name is derived. This little town is essentially Spanish, and the North-European traveller is at once struck with the style of the houses, the appearance of the people, their habits and costumes, and a number of those trifles which are so interesting, but admit so little of description. The houses are small and very dirty, with open fronts and wooden balconies to every window, the shops being in fact mere sheds, little to be distinguished from unusually neglected pigsties. The costumes of Northern Catalonia were seen both near the entrance of the town and in it, and they differ somewhat from those of the

South of France; the men wearing bright scarlet caps and broad red sashes, striped and often fringed at the edges; and the women bright handkerchiefs on the head, instead of caps. The customs of smoking and drinking chocolate were immediately forced on our notice, and something of the Spanish indifference to the whole world impressed us with a rather unfavourable idea of the people.

The general geological condition of the country between the first approach to the Pyrenean chain and its termination at Junquiera, is sufficiently simple, and may be described in a few lines. After leaving the rich plains between the Tet and Tech, a much less fertile valley is crossed; the debris from which the soil is derived ceasing to consist of calcareous marls, as in the former case, and being formed chiefly of quartzose and micaceous rocks derived from granite. The mountains, rising to a small elevation near Boulon, and consisting first of schist, and afterwards of granite, traversed by quartz veins, are found still further on to contain limestone and grey marble, dipping N.N.E. between Ecluse-haute and Ecluse-basse, before reaching Bellegarde. These are evidently metamorphic. Still further on the schists and granite alternate for a short space, but are soon seen to pass into unbroken granite. Not far from Bellegarde, however, nearly vertical schists re-occur, and thence to Junquiera granite everywhere prevails. A little to the west of the line of road across the pass, and in the line of strike of the limestones, mineral waters occur in several places.

At La Junquiera is the Spanish custom-house, and there, of course, the usual formalities of passport and examination of luggage were gone through. Our passport being in proper order, and our bags and portmanteau not very large, we were soon in a condition to look about us, and were not a little amused at seeing a gigantic trunk belonging to a fellow-traveller disgorge a vast collection of scraps of black stuff, lace, silk, &c., packed round a huge iron crucifix. Owing to some cause which we could not clearly make out, the old lady to whom these belonged could not arrange matters with her Catholic Majesty's representatives of the *aduana,* and she was actually left behind when the rest of us with the diligence went on, apparently much to her consternation. Some little attention is required here, as the authorities are very strict, both about passport and the intro-

duction of cigars and French goods. Much has been said as to the advisability of feeing the various authorities, and I doubt not that any such generosity would be readily accepted; but I can speak in my own person as to the absence of any necessity of the kind, as I passed everywhere with the greatest facility and no delay, without bestowing a single real in this way; nor could I find that my fellow-companions either paid anything or were relieved from any difficulty if they did so. We found the public officers on the frontier much like their fellows elsewhere, and certainly not worse than their neighbours the French. For the sake of those who may follow in our footsteps, I may mention that a *visa* of the Spanish consul at Perpignan is absolutely requisite before crossing into Spain, and it is understood, though with what truth I am not prepared to say, that the signature of the Spanish Ambassador in London or Paris is also needed. My own passport (from the foreign office) was completely *en règle*, and I found it a far less expensive document in Spain than I had previously done in Italy, the continual repetition of *visas* mentioned and advised by Mr. Ford, in Murray's Handbook, being in no case asked for.

Leaving the custom-house and the group of dirty houses around it, forming the town of La Junquiera, we advanced to Figueiras. The road runs between and by the side of hills, frequently crossing the river Llobregat, often the dry bed of a torrent, but sometimes almost impassable from the presence of the torrent itself, and giving the first foretaste of the peculiar condition of most of the Spanish streams. After about two leagues the river Muga is passed, and we enter at once on one of the vast plains, here covered with rich vegetation, which also characterize the Peninsula. Immediately on emerging from the hills (which are of metamorphic rock), we come upon an alluvial deposit, apparently derived from the disintegration of granite; and here at once begins the modified flora of Spain, olive-trees reappearing, and numerous fruits and vegetable productions indicating a return to the fertility of the country north of the Pyrenees.

Figueiras is a pleasant town, situated in the middle of the plain; the streets are wide; there is a square, and the houses are decently built, the inn being a clean, respectable-looking house. At this place the diligences are changed, the rest of the

journey being made in a Spanish conveyance; and here also the luggage is re-examined, with the exception of such articles as have been *plombé* at the first frontier. Here we began really to feel ourselves in a country in which light and heat are in excess, and where comfort is to be sought for in the gloom of darkened rooms. All the shutters were shut to avoid the noon-day sun, but the walls and furniture were of the gayest, most strongly contrasted colours. The rooms were large and convenient, and tolerably clean, and the hotel on the whole by no means unpromising. Our first experience of Spanish, or rather Catalonian cookery, was also made at this point in our journey, and it did not prove at all less satisfactory than we were prepared to expect. The meal included a curious mixture of tough fowls, tougher beef, cabbage, haricot beans, pork, potatos, and raw tomatos soaked in oil, with fried gourds, which latter might be singled out as especially greasy, where everything was soaked and fried in oil. The fruits, however, such as melons, pears, grapes, and peaches, were excellent and abundant, so that whilst the peculiarities did not make us wish to exchange our own home style of cookery for that of the Peninsula, there was no difficulty in making a very fair luncheon.

After waiting at Figueiras for about two hours, until the mid-day sun was a little past, we started in another diligence on the road to Gerona. The Spanish diligences are, on the whole, larger, heavier, and more cumbrous, but at the same time more comfortable than the French, and far exceed in speed those of the South of France. Eight, ten, or even twelve horses or mules are attached two abreast, according to the state of the road; a postillion is mounted on the near leader, and there is a driver, who is, however, more frequently off than on the box. The reins reach only to the two wheel-horses, the rest being altogether without such guidance. Besides the coachman and postillion there is a third person provided with a whip, and all three begin at starting a series of shouts, enough to alarm the most courageous passenger, and the whole affair is off at a rapid pace over the stones, rattling and bumping and vibrating in the most frightful manner, now rushing through the crowd assembled to see the departure, then swinging desperately through a narrow street, making turns at right angles half a dozen times in as many minutes, and at last shooting out safely between the low

narrow gateway of the town, which seems to have been constructed so as exactly to allow the monster conveyance to pass, but would as infallibly destroy anything above or on either side, as it would crush to atoms anything beneath it. Once out of the town, the postillion jumps down, gets up to the top of the carriage, and goes quietly to sleep amongst the luggage for an hour or two, while the horses, totally without any control, except that exerted by the voice of the driver and the management of the wheelers, gallop, trot, walk or stop, as the condition of the road seems to them to require, or as they may choose to arrange with the driver himself. At first, I confess that I felt a good deal of astonishment, and not a little alarm at this state of things, but I soon found that everything was going as usual, and that the horses perfectly understood what they were about; and so the matter continued, our postillion sometimes on his horse, but far more frequently on the ground, on the box, or among the luggage, till we got near a town, when the only change was that the three authorities provided with whips exerted their voices yet more than before, and with the chorus of *hi's, ho's,* and numerous utterly unwriteable sounds, the carriage was twisted somehow or other into the narrow court-yard of a house just large enough to hold it. Such, without exaggeration, is any one stage by a diligence in the north of Catalonia, the birthplace of such conveyances in Spain.

The road from the French frontier on the east of Spain passes round the walls of the ancient city of Gerona, and thence runs to Mataró, from which port there is a railway completed to Barcelona. After once passing the Pyrenees, there is only a small transverse chain of hills to be crossed before reaching the coast, but we obtain in various places a view of some of the mountain scenery characteristic of the interior of the Peninsula. Several streams and dry river-courses are crossed, most of them without bridges, though apparently at some seasons conveying considerable quantities of water, and the road after passing Gerona advances at once towards the shores of the Mediterranean. Gerona itself is a highly interesting town of considerable size, and its walls are washed on one side by a small river (the Fluvia), with water in it, by no means a common event in Spain. The town has a cathedral approached by a lofty flight of eighty-six steps, but the façade is not in itself good. The streets are

very narrow, and were shaded by a kind of avenue formed of innumerable branches of some plant, suspended by strings drawn across from house to house. The place is clean, and very lively, and the people seemed all to be out of doors. We staid there an hour, which we passed pleasantly enough in wandering about the town, as the ostensible object—a dinner—was rather too close on the meal we had taken at Figueiras to be tempting under the Spanish *régime*. While at this town we saw a curious funeral procession, the corpse being carried on the bier with the face exposed. The evening was closing in when we left Gerona, and we found enough to do in admiring and rejoicing in the exquisite softness and freshness of the air, the pleasant temperature, the deep blue sky, and the signs of cultivation manifested from time to time. Towards morning we reached the coast, and by five o'clock arrived at Mataró. At six we left, after taking a cup of chocolate made in the true Spanish style, and soon after seven were in Barcelona by the railroad.

One of the matters that very much strikes a person unaccustomed to the peninsular sun and temperature, is the appearance there of some kinds of vegetation which we are accustomed to regard as almost tropical. Thus all along the road from near Gerona, and by the coast, the aloe is seen forming hedges, sometimes mixed with a large kind of cactus, and the lofty flower-stalks of the former plant are so common, as almost to give a character to the vegetation. The orange-tree too, instead of being a stunted and rather ugly tree, here puts on its natural appearance, and grows freely and perfectly well, with its fruit in all degrees of ripeness, both green and golden at the same time. These and similar proofs of the climatal relations on this side of the Pyrenees are interesting to see, though perhaps rather trite to remark on, but they add much to the charm of a new country.

The country from Figueiras to Gerona is across undulating ground, with streams of running water and fair cultivation. There are also some inconsiderable ridges of sandy limestone and marly sandstone of the oolitic period, and about half-way a few narrow gorges with granite and porphyritic rock. Most of this country, however, is covered with alluvial deposits derived from decomposed granites. Near Gerona a lofty ridge of metamorphic schist is met with, rising suddenly to a height of nearly

3000 feet, and having at a few points granite or porphyritic rock. This connects with the spurs of the Pyrenees, but is somewhat exceptional in its character. It brings up to the surface certain fossiliferous beds of palæozoic age, and effectually breaks the monotony of the plains on this part of the coast. Further on towards the coast the tertiary beds are repeated, but they appear to belong to a somewhat ancient part of the series, and abound with nummulites and other foraminiferous shells. Very extensive deposits of the cretaceous period range westwards, almost to the Bay of Biscay.

Not far from Gerona is the interesting group of extinct tertiary volcanos, at Olot, described by Spanish writers early in this century, and more at length in 1806 by Dr. Maclure, an American geologist. The whole country hereabout is occasionally subject to earthquake action, and numerous volcanic products, such as lava, volcanic ash, pumice, and even columnar basalt, have been observed. The age of this Catalonian volcanic district is uncertain, but no proof exists of any eruptive action having taken place within the historic period.

The tertiary deposits on the coast near Gerona extend not only to Barcelona, but considerably further south, and even reach to the mouth of the Ebro. A short distance in the interior the cretaceous and altered rocks appear, and near Barcelona are sandstones and limestones of the carboniferous period, besides some granite*. There are thus two granitic and metamorphic ridges, more or less nearly parallel to each other and to the Pyrenean chain and occurring between the main ridge and Barcelona. Most of the surface-deposits, however, even to a considerable depth, are the result of decomposition and disintegration.

The country near Barcelona is fertile and well cultivated, yielding abundant returns to the labour of the husbandman. The high road runs through an avenue of nut-trees, for whose fruit Barcelona has long been famous, but the railroad leaves little to be observed in this as in other places. Still, the approaches to the city are fine and even grand, and there is an air of movement and progress about the people, that shows at once

* Coal is described to exist in workable beds at no great distance, but I had not time to visit the locality.

their difference from the hidalgos of Castille and other parts of ancient Spain. Indeed, the fact of the railway being completed for some other purpose than amusement is of itself sufficiently characteristic.

The railway from Mataró is constructed entirely on the English plan, the carriages, &c. being exactly like those used in our own country, and just as uncomfortable. The distance is seventeen miles, and the time occupied by the journey about an hour. The road runs close along the shore between the sea and a low but picturesque range of hills, and as it approaches Barcelona there is a decidedly cheerful and busy aspect.

The costumes of the people in this part of Spain (Catalonia) are not, on the whole, either very picturesque or characteristic. The sash or girdle of red or blue material going several times round the waist, the peculiar long Phrygian cap of bright red woollen stuff turned back square over the head, the sandals of packthread only covering the toes, the bare legs and the high waists are the points that most attract attention. In the towns, many but not all these are neglected; and although in the crowd that assembles nightly, from dusk to near midnight, on the *Rambla*, as the principal promenade is generally called, there is a decided preponderance of such dresses as are familiar to us in England, there is yet a fair sprinkling of bright colours as well as of dark complexions.

Barcelona, whose general appearance from the sea is bright, lively, and picturesque, is a fine flourishing city, well-placed, but, unfortunately for its advancing condition, it is enclosed within walls, and surrounded by fortifications. Its origin dates back very far into history, as it had existed a long time before being refounded by Amilcar Barca, the father of Hannibal, by whom it was called Barcino, whence its present name. It has now upwards of 120,000 inhabitants. The streets are narrow, but tolerably clean; the houses lofty, but not very handsome. The churches and public buildings are interesting, and several of them ancient, the cathedral especially, which, like many others in this part of the world, is approached by a long flight of steps. All the churches are extremely dark in the interior, owing to the almost total absence of windows in the nave, and even transept. A few stained glass rose and other windows, placed very high, admit sufficient light to answer all required purposes, and the absence

of too many entrances for the sun keeps the building cool during the greatest heats of summer.

The interior of the cathedral of Barcelona surpasses in grand and solemn effect, and rivals in architectural beauty, the very finest of those in the north of Europe. As it is in the best sense a Gothic edifice, it differs greatly from most of the Italian cathedrals, which are either classical (so-called), or afford a mixture of styles which I confess has few charms for me.

One peculiarity in many of the Spanish ecclesiastical edifices is worthy of notice, as contrasting with the custom in other countries. In the rest of Europe the exterior is generally the finest part, and that which is first completed, while the interior is often far less imposing, and is even left bare and naked in appearance. Here, on the contrary, it is not uncommon to find the west or principal front either altogether absent, or very imperfectly finished, the towers or spires not more than indicated, and the whole of the exterior wanting in grandeur and harmony. Such is the case to some extent with the cathedral of Barcelona, for although there are two handsome towers of no great elevation, the decoration of the west front is not even commenced, and we see a flat surface almost like a dead wall, with a few coarse paintings in fresco to indicate the intention of the architect. The inside, however, amply atones for any such imperfections. Lofty, elegant, and even light, in the grouping of the numerous and large clustered columns that support the noble roof and sketch the position of a sort of central choir, a peculiarly solemn and almost stern effect is produced by the total absence of windows near the ground, and the rarity and small size of the openings for light, which even where they do occur are filled for the most part with fine old coloured glass, and admit but little of that broad intense glare of day which prevails outside. On first entering it is difficult to recognise any object distinctly, but the eye soon becomes accustomed to the partial gloom, and the rich yet simple proportions of the interior become developed. It is customary in some of the Spanish cathedrals to place the consecrated Host in a magnificent framework, representing the Ark of the Covenant as constructed in Solomon's Temple; and this display of gold, silver, marble and painted woodwork is really not so inconsistent with the feeling of the place as might be expected, and as it would be if it were not for

the gloom. In the cathedral of Barcelona there is also an open descent, by a wide flight of numerous steps under an elliptic arch, from the middle of the choir to the crypt, exhibiting an altar with some relics, and by no means in bad taste. The high altar, and indeed all the altars,—of which the number, as well as that of side chapels, is very large,—are decorated and built up with gold and tinsel to an unusual extent; and although this is not very pleasing under ordinary circumstances, the effect when illuminated is extremely fine, and hundreds of wax lights are sometimes employed for this purpose, being placed so as to bring out the most impressive result.

The cloisters on the north side of the cathedral are of singularly elegant light gothic work, and enclose a curious and pleasant garden. They are all that cloisters should be; calm, quiet and solemn, but perfectly light and dry, and in this respect very different from those sad abodes of damp and gloom which our English climate produces, when time and neglect have exercised their influence on such works of our forefathers.

Barcelona is essentially a manufacturing city, and it is both interesting and curious to mark the well-directed activity of the people assisted by the powers of steam and machinery, contrasting strongly with the constitutional idleness of the rest of the Spaniards. We here see the steam-engine and the loom in close contiguity to the aloe, the cactus, and the orange-tree, and there is no present appearance of any ill effect produced on these or on the habits of the people.

One word before concluding this chapter, as to the first impressions produced by the manners of the Catalonians. As a people, they are certainly not remarkably polite or attentive to strangers; the comforts to be found at the hotels, whether in essentials or luxuries, are by no means numerous, nor are the shops at all well supplied with goods. At Barcelona we went to the Fonda del Oriente, a large hotel in the principal street (La Rambla). It was certainly one of the best hotels in the place, well-frequented, and the table d'hôte excellent, but the bedroom into which we were first shown was filthy even beyond the ordinary expectations of a traveller in the smallest and most neglected villages. We afterwards got a room which was a little more comfortable, although still dirty, and abounding with insects. The only mode of cleansing the brick floors, which seem common to

all the rooms, is by sprinkling water and occasionally stirring up the dust with a broom. This seems to have a favourable effect on the constitution of fleas, since they always appeared particularly lively after the ablutions.

Notwithstanding such trifles, there is no reason why those accustomed to travelling, and prepared to endure the smaller inconveniences of life, should not visit these interesting towns, which are so perfectly within reach. With few exceptions, the travelling is more agreeable, the annoyances from personal dirt and garlic less considerable, and the facilities of getting along on the high road almost, if not quite, as great as in the north of Italy. The heat is considerable in summer, ranging from 76° Fahr. in the night and morning to 85° or 86° in the middle of the day, but there are pleasant sea breezes in the morning and evening, which prevent any feeling of oppression. The coolest time of the day is about 4 A.M., and the nights are delicious for travelling.

The country around Barcelona is pretty, and may safely be called interesting, but advancing towards the interior on the road to Zaragoza, it begins soon to take the character peculiar to Spain, and resolve itself into a somewhat lofty plateau, with little vegetation and much dust. Before the Zaragoza road branches off from that to Tarragona and Valencia, which is not within several leagues of the town, some interesting views are obtained of the peculiar scenery of Monserrat and its vicinity, which are equally striking and beautiful. For the first ten or twelve leagues the road runs through wooded ravines and scenery which has been compared to that of Switzerland. During all this time, and for a considerable distance, indeed as far as Cervera (twenty leagues from Barcelona), we are gradually rising towards the higher level which is there reached, and is continued with more or less undulation into the interior. Cervera itself is a poor town, but looks well from a distance, being situated on a height and seen on all sides. Thence to Lerida the traveller finds but little to occupy him, but at this city the river Segre is crossed, which afterwards uniting with the Cinca, forms one of the principal tributaries of the Ebro, and empties itself into that stream at Mequinenza, a few leagues to the south.

Advancing from Lerida and crossing the Cinca, the kingdom of Aragon is entered, and at the same time, owing to the pre-

sence of water, a rich, luxuriant vegetation takes the place of the dry, parched hillocks between the two streams. The town of Fraga is on the banks of the Cinca, and is fine and picturesque, but the rest of the road to Zaragoza offers little worthy of notice till we reach the valley of the Ebro*.

The whole distance between the capital of Catalonia and that of Aragon may be described, in a few words, as a high broken table-land near the lower step of the Pyrenees, never, however, affording fine distant views of the high mountains, owing to the intervention of other and much lower flanking ranges. The ground is generally barren of trees, and is only partly cultivated as arable land.

If, however, instead of taking the high-road, we descend the Ebro, or rather follow its course on land (as the river is not navigable at present), we shall find that the dry, barren and unsatisfactory high-road is exchanged for a route which affords a series of interesting observations connected with the past history, and bearing on the future prospects of this great river.

The Ebro is one of the principal rivers emptying into the Mediterranean. It drains nearly thirty thousand miles of country, having a course of more than 400 miles. It rises in the Western Pyrenees (in the province of Santander, in Old Castile), not far from the Cantabrian coast, whence it proceeds through the provinces of Burgos and Zaragoza, and after passing through an interesting section of Catalonia, enters and crosses part of the province of Tarragona, where it finally reaches the Mediterranean.

In its course it passes a large number of towns, many of them anciently, and some still, of importance; but, owing to the fact of its bed being now greatly choked and the navigation interrupted except at distant intervals, there is no comparison whatever between the former and present state of these towns. When in former times the country was in possession of the Moors, a complete system of irrigation of the land on both sides was so contrived as to utilize almost all the water of the stream, by damming up its bed with huge masses of rock. Canals have also been constructed of larger size than were needed for mere

* Zaragoza itself, the capital of Aragon, is a large and well-built, but dull city—well-situated, but without business. The main street is extremely handsome, but my knowledge of it is confined to a passing glimpse at midnight.

irrigation, and the general result has been that the whole bed of the river has become choked up, and a needless accumulation of transported material entirely precludes the possibility of bringing the stream back to its former course without the construction of works on a very extended scale, the difficulties attending which are every year becoming more considerable.

The Ebro receives in its course a large number of streams coming down from the Pyrences, and some of these are of no inconsiderable magnitude. Even in the latter part of summer, when I crossed some of them, I found an abundant supply of water rushing at a rapid pace, and evidently conveying important, although unequal, additions to the volume of the principal stream. As far as I could learn also, these sources are rarely dry even towards the latter end of a hot summer, and as I have seen them in the month of August on two occasions, I am prepared to believe that much water is thus constantly conveyed. It must be remembered indeed, that during unusually dry seasons, hardly any even of the great rivers of the Peninsula actually convey water to the ocean; but as the Ebro is one of these*, and the tributaries are fed by rains falling on the whole length of the Pyrenean chain, it must be a very unusual event for all its sources to fail entirely and at the same time.

The valleys of the Ebro and its tributaries are like almost all the valleys of Spain, extremely rich and productive whenever they can be irrigated, and utterly barren without water. The Romans seem to have taken advantage of the river for fostering commerce and improving the means of intercommunication, and so long as they remained masters of the country, the Ebro appears to have been navigable not only to Zaragoza, but even as far up as Logroño, on the confines of Navarre and Old Castile. This is rendered probable by the condition of the stream at this point, and the strong bridge with its huge triangular buttresses and corresponding recesses. After the Romans had left, the country suffered from neglect, and then, when the Moors were in possession, these singular people, following out the practice adopted in warmer countries, and more fully alive to the advantages of agricultural success than anxious to convey to a distant market their superfluous produce, lent all their efforts to

* Neither the Ebro nor the Guadalquivir has been known to be so much affected by drought as not to admit of partial navigation by boats.

check and divert the course of the stream. They thus in time effectually succeeded in raising the bed not only of the river, but of all the numerous small channels through which it was conducted along the fields, the mud accumulating that would have been conveyed further down, and the river-course permanently dammed up by placing in its bed large rocks and obstacles of all kinds, and ensuring a much more rapid evaporation than would have obtained naturally. In the course of centuries, the effect has been most disastrous, and except for a short distance near its mouth, and in a few small canals at distant points, the Ebro is now practically lost as a navigable stream.

The damage thus caused has been increased rather than diminished by the occasional torrents rushing down from the mountains and sweeping with resistless violence over the plains. In the natural course of things, these would have flushed the river and removed obstacles; but as it is, they have merely added to the mass blocks of stone deposited intentionally, and artificially placed. Such impediments, when too large to be carried away by the floods, have now become impenetrable walls, enforcing the subsequent divergence of the stream, lengthening its course, diminishing therefore its rate of motion, and rendering it afterwards more easily interfered with by other impediments.

The value of water in Spain is greater than can be easily understood by those who have not visited this parched and thirsty land. A perfect paradise where this element is present, and a perfect desert in its absence, no one can wonder that the Moors, in their anxious love for gardens and delight in succulent vegetable food, should exercise all their ingenuity in ensuring the means of existence and enjoyment. Their very ingenuity, however, has ruined the country, and the plains of Aragon, one of the most fertile provinces of Spain, lose half their value from the absence of regularity in water supply, and even when most productive are of little use to the rest of the country, owing to the want of water-communication to carry the crops to market.

In considering the valley of the Ebro, and the course that has to be taken by the waters that run through it, the high level of the land on the south of the Pyrenees, as compared with the plains of Languedoc, must not be forgotten. The whole of Spain in the interior is at a high level, and the rivers generally

run through fissures of greater or less magnitude in this plateau. The greater part of the streams that feed the rivers, and the upper part of the main channel, are usually at a high level, so that the water does not run off in torrents, but quickly occupies a definite channel. In its further progress the river valley is more shut in, and the bed descends at a greater average rate than is usual in plain countries. The consequence is, that when obstacles are placed in the way, or occur naturally, the bed is sooner choked up, and the general injury to the stream greater than under other circumstances. The rivers will also naturally be less navigable, more variable and more impeded by shoals and rocks, while there will of necessity be a more constant accumulation of large blocks and boulders than when the general level of the country was nearer the water-level.

The valley of the Ebro, where it opens out and admits of extensive and easy irrigation, is remarkable for extreme richness. This is the case near Zaragoza, where there is a somewhat extensive flat, well-watered and converted into a perfect garden. A portion of the stream turned into a canal traverses about fifty miles of plain country, and not only fertilizes the land, but ensures navigation. There are several boats on it, conveying passengers and goods at very small cost, and at a more rapid rate than by the ordinary mode of land-carriage.

Below this rich plain, where the valley closes in and hard rock appears near the water's edge, the navigation is stopped, and the injury effected by the Moors becomes apparent. For a distance of upwards of 170 miles, the water-line is tortuous and the river-bed narrow, the small tracts of land near the water's edge being covered with delicious gardens, while the whole of the upper lands are completely divested of vegetation, except where a few scattered and dwarf pines seem to point to hopeless aridity as the cause of the barrenness.

Below Cherta to Tortosa, and thence to Amposta, the country opens out once more, and the mountains rise and recede from the valley. The river from this point is quite capable of being rendered navigable at moderate cost, and always conveys down a large body of water. From Amposta to the sea is a wide alluvial flat, consisting of about 70,000 acres of low land, which is at present unhealthy and subject to inundation, but which might readily be drained and afterwards irrigated. The fertility and

32809

consequent value of this tract under such treatment would be unquestionably very great.

The quantity of water conveyed down the Ebro at Zaragoza at low water is estimated at nearly 100 cubic yards per second, and at Amposta upwards of 260. This is of course independent of all loss by evaporation and irrigation, and also of occasional increments by freshets, which are unfrequent and extremely transitory. The rapidity of the current varies from half a mile to four and a half miles per hour.

It is chiefly between La Cherta and Amposta that the scenery of the mouth of the Ebro is grand and picturesque. It is so more from the bold and simple outline of the hills and their delicate grey tints seen against the deep blue sky, than from any varieties of colour or vegetable covering. Here, as so commonly in Spain, all kinds of forest vegetation are absent.

The delta of the Ebro already referred to, called from Moorish times *Alfaques*, extends for about fifteeen miles from north to south, and eleven from east to west, and the channel through which the waters are delivered is very little subdivided. There is also a Port Alfaques, affording scarcely any shelter, but celebrated in history, and yielding a good deal of salt from the evaporation of the sea-water in shallow lagoons which abound in the alluvial mud of which its houses are built. All this part of the coast greatly requires draining. Like many other spots offering natural facilities for the landing or habitation of people, it has numerous historical reminiscences, and is especially known as the place where a great victory was obtained by the Carthaginians under Amilcar over the Roman fleet.

Having thus obtained some idea of the general condition of that district of the north of Spain watered by the Ebro, let us return to the coast and trace the condition of the country as seen on the high road going southwards from Barcelona towards Valencia.

CHAPTER THE SECOND.

TARRAGONA AND VALENCIA—THE COUNTRY AND THE TOWNS.

LEAVING Barcelona in the evening at about 5 o'clock for Tarragona, we enjoyed greatly the fine scenery surrounding the town, coloured by the rich tints of the setting sun. For the first few miles the road enables one to see little more than a somewhat wider range of the coast district than could be observed from the sea, but on approaching the hills, we meet with the peculiar and interesting features characteristic of the Peninsula. Of these, the extensive but dry river-beds, and the numerous deep and narrow chasms or *barrancas*, which have at some time or other certainly been water-courses, but whose bottoms are now covered with a rich and luxuriant vegetation, including trees of many years' growth, produce scenery not to be seen elsewhere in Europe, and attracting the attention of the naturalist, both by the peculiar nature of the physical geography of the country and the variety of natural products obtained from it. These features claim also the attention of the geologist, as affording proof of certain modifications of the surface, due to the eroding power of water, although on a scale very different from that observable in England.

The low ground and parts of the hills near Barcelona are covered thickly with a boulder and sand deposit of deep red colour easily washed away. This is doubtless due to the decomposition and disintegration of a slaty and red sandstone rock, developed in the neighbourhood, and seen in the cuttings made for the passage of the road in various parts of the hilly range crossed in proceeding southwards. These hills are partly granitic and partly calcareous, but they are a good deal metamorphosed, and gradually rise in altitude and form a more distinct barrier towards Tarragona. They are there covered with tertiary rocks and contain some fossils, but the geology of the whole district is obscure, owing to the peculiar conditions under which the rocks are presented.

The geological as well as geographical peculiarities of Spain

are everywhere connected with the existence of table-lands of considerable elevation, having numerous broad and deep ravines, separating rocks which were once continuous. With few exceptions the mountain-chains are rather portions of the table-land than true detached ridges rising to any marked elevation, and thus the interior of the country, although of great elevation, presents few features of bold rocky scenery compared with its real mass and mean altitude above the sea. Many of the high lands reach to the sea, and there terminate abruptly in cliffs, and these are usually intersected by crevices, across which the only way is by a steep descent and subsequent steep ascent. Thus in coming towards Tarragona, the road runs down a steep slope towards the Mediterranean, and the town is built on portions of this slope, which commences with a kind of terrace about 50 or 80 feet above the water, and rises rapidly many hundred feet behind, in a succession of highly picturesque rocky steps. The town is considered to have been founded by the Phœnicians, but was afterwards the seat of a highly important Roman colony, which at the commencement of the Christian era became for a time the habitation of Augustus, and when universal peace reigned through the world, the decree for closing the Temple of Janus was promulgated from hence. At that time it boasted a million of inhabitants. Nearly five centuries afterwards it was partially destroyed by the Goths, and at a later period was utterly annihilated by the Moors, who left it in this state of desolation and almost without inhabitants for four centuries. Since then it has been in Christian hands, and has become a tolerably active town (for Spain) of about 11,000 people, the buildings being tolerable, although the fortifications, which have been partly renewed and again destroyed and rebuilt, are in a crumbling state.

Notwithstanding the general destruction of the old buildings, the cathedral, which was commenced early in the twelfth century on the ruins of a Roman temple, is still extremely fine, and in a singularly pure Norman taste, with a mixture of Saracenic. Many portions are of a much more modern date, and some of the chapels were only completed towards the close of the last century. Simple and noble in its general proportions, rich in its decorations, and admirable in many points of detail, it attracts and well repays close examination. The west façade, seen at

the end of a narrow but picturesque street, and approached by a lofty flight of steps, is very fine. The interior is also good, and the ark for receiving the Host is richly finished, while the painted glass in the transept is unusually magnificent. The cloisters here, as at Barcelona, are exquisite, and contain some fragments of Moorish architecture in the walls. The cloister garden is very pretty, and full of quaintly-cut trees.

The chief charm of Tarragona is in the utter desolation of its vast defences, contrasted with the glories of nature immediately around. Placed upon a rock of hard white limestone rising from the sea to a height of nearly 800 feet, its walls are built to a great height above this, and the fortifications have included a considerable area beyond the town not now occupied. From the terrace at the foot of the inner walls a superb view is obtained of the Mediterranean, while the distant Sierra is seen stretching far away towards the south and east, and a nearer and lower range of hills is partly covered by vegetation. A few roads and some remarkable walls are traceable to a great distance; but the aspect of the whole is lonely, severe, and grand. Marks of war are seen everywhere, as the town has been often attacked and still more frequently taken by hostile armies, and nothing is wanting to complete the impression of sadness that accompanies the feeling of admiration at the grandeur of the scene. It is a case in which the pencil even of the greatest artist could hardly succeed in producing the required effect, as the charm of feeling one's self on a spot in which nature and man have done and destroyed so much is perhaps necessary to bring the imagination and the intellect to a proper tone, and enable one to appreciate the strong contrasts that exist.

From Tarragona to Reus is a tedious ride of about two hours, the distance being stated at two leagues (seven miles), but from the rate of travelling and time occupied appearing to be half as much again.

Leaving Tarragona at 5 A.M., we arrived at Reus about 7, having been unable to obtain room in the diligence to Tortosa, which we hoped to have reached the same day, and finding it better to be this one stage in advance. Reus is a thriving, bustling, modern town, but offers little for remark beyond the contrast observable between it and Tarragona, and the rarity of any appearance of business in any Spanish town whatever.

The road hence to Amposta is chiefly along the shores of the Mediterranean, with a considerable but barren range of hills completely excluding any view into the interior, along the whole distance. The hills are composed of limestone, and the space between the foot of the hills and the present level of the Mediterranean presents all the appearance of a raised sea-beach, being chiefly made up of gravel and rolled or angular boulders of various sizes, evidently derived from the adjacent rock, which weathers easily on exposure.

At some distance from Amposta the scenery begins to assume a different and more varied aspect; the mouth of the Ebro opens gradually before us, and we see the grand range, enclosing the wide valley of this noble river, expanding before the eye in bare and naked beauty. The mouth of the stream, and its long delta extending like a tongue of sand into the Mediterranean, then come into sight; and on the opposite bank is seen the ancient town of Amposta, formerly a place of some importance from its position, but now much decayed and lifeless, though rather more animated than usual, owing to the recent commencement of works about to be carried on on a large scale to improve and canalise the navigation of the Ebro, a project which seems perfectly feasible, and which, with proper management, cannot fail to yield ample returns for almost any amount of capital properly expended. The Ebro is not very broad at its mouth, but the body of water is considerable. The water is muddy, and the current tolerably rapid, but not so much so as to be at all dangerous.

Leaving the main road at the ferry which here crosses the river to Amposta, and keeping on the north or left bank, we struck off on a cross road to Tortosa, in a tartana,—a common enough vehicle in Spain,—provided for the purpose, and resembling a small light omnibus placed on an axle between two wheels without the intervention of springs, which indeed would be utterly useless in the present state of the roads, as they must inevitably be broken before the vehicle had advanced a hundred yards. Proceeding at a slow mule's walk for about two hours, we accomplished the two leagues that intervene between Amposta and Tortosa, and reached the latter town, which is well-placed, part of the town being on the river and part at a considerable height above, while the whole is commanded by a

fortress—picturesque if not strong—frowning over the adjacent country.

The town itself presents few objects of great interest. The interior of the cathedral is fine, and the cloisters pretty, but the architectural effect is destroyed by a barbarous admixture of bad and corrupt classical styles with the Gothic, which was originally intended to characterize the building. The people in this part of Catalonia construct their houses and streets so as to defend them as much as possible from the sun, and have little regard for any other object; least of all do they care for uniformity or regularity of construction, and thus it happens that in many cases, as here, it is totally impossible to see the exteriors of the public buildings from any favourable point of view.

On arriving at Tortosa we found that there was to be a sort of mock bull-fight in the circus in the afternoon. After dining at the small inn (the best in the town) where we had put up, I proceeded to the scene of the combat, which, as usual in Spain, is outside the walls of the town, and is most picturesquely placed immediately below one portion of the fortress, and commanding magnificent views of the country. The building itself is shabby and poor, but constructed after the fashion of the Roman amphitheatres, and quite open at the top. Unlike the Roman custom, however, the seat of honour and the grand tier of boxes is the uppermost, there being below it another nearly similar range, and then numerous rows of seats for the mass of the people, descending to within about six feet of the ground, so that from time to time the more active of the spectators jump down to the stage and become actors, while on the other hand the performers themselves, both biped and quadruped, occasionally pay visits in return. After waiting patiently for an hour beyond the time announced, about a dozen rather ragged fellows, with cloaks of coloured calico in their hands, entered the arena at the sound of a trumpet in a sort of procession, bearing with them a stuffed figure resembling a very indifferent Guy Fawkes on the 5th of November, and having bowed to the Alcalde, who was seated in a state box, the orchestra struck up, the trumpet sounded again, the door was opened and out rushed a bull. It must be understood that there was nothing of earnest in this case, as the bulls were young and by no means fierce, and the object of the men was more to tease than torment their

victims, who with one exception were let off without any injury whatever. The whole amusement consisted in the different ways in which this teasing was performed, at one time holding out the red and yellow cloaks and attracting the animal by trailing them on the gound; at another exposing a man in a wooden frame to the horns of the animal, who could do no more than throw over the frame without hurting the inhabitant; another time making the poor creature exhaust his fury on a basket, and such like tricks. At length the stuffed figure above referred to was once more brought in, and after being for some time dragged about by the heels, as if made of straw, it gradually warmed into action, first standing up, and then dancing.' A bull was now introduced, who rushed at the figure and of course upset it, without however doing mischief. When this had gone on for some time there was a short pause, and then one of the bulls, who had been several times teased, was exposed to still more exciting play; sticks without points were poked at him by a number of men ranged in a semicircle; fireworks were stuck into his side; and at last the matador—a dirty butcher-like fellow with a very shabby-looking straight sword—was introduced, made his bow, and proceeded to his work of despatching the bull, in which he succeeded, but not without making numerous false and ineffectual attempts, and inflicting some cruel but useless wounds. The whole affair was a burlesque, except to the poor bull who was killed, and was chiefly interesting as illustrating the habits, feelings, and costumes of the people. I was told that between 2000 and 3000 persons were present, and the effect of this large multitude assembled in the open air in broad daylight, dressed in several varieties of costume, was decidedly good.

In this part of Spain, and a little further to the south, the climate on the coast is almost subtropical, and the people being much exposed are of the darkest brown-red colour*. The common dress both here and in the adjoining province of Valencia is simple and picturesque, consisting of a sort of shirt of coarse linen, the lower part of which is sewn into very

* The view of Dr. R. G. Latham, that darkness of colour in the human race is produced by exposure to low, flat, alluvial soils at the mouths of rivers in hot climates, is supported by the present state of the people in the east of Spain. The dark colour prevails only on the coast.

wide short trowsers, reaching about half-way down the thigh. The waist is tied round with a sash, generally of some bright colour, and the head covered with a kind of turban constructed of a handkerchief. The feet are covered with sandals. Thus clothed, the peasants are able to stand exposure to the sun under circumstances which would almost seem impossible. Their food is chiefly vegetable, and includes a large quantity of vegetable oil and stimulants, such as onion, garlic, capsicums, &c., but they also consume grapes and melons to a surprising extent. Some idea of the abundance of fruit may be had, when I state that the extreme price asked in the market, in the middle of August, for the best grapes in small quantities, and of a stranger speaking the language very imperfectly, was rarely more than a penny per pound; that of magnificent apricots, apples and peaches being about the same. The grapes, however, are taken freely by every one from the vines by the road-side, and the trespass, if any, is hardly noticed.

The road from Amposta to Valencia, carried for the most part along or near the shore of the Mediterranean, offers little that admits of detailed description. With the exception of a range of hills running into the sea at Peniscola, which is a rather remarkable rock crowned with a fortress, like a small Gibraltar, there is little high or undulating ground, but the landscape is everywhere rich with a profusion of vines, olives, figs, Indian corn, rice, and various food-bearing plants and trees, which, as is usual in Spain, entirely supersede trees of larger growth. At no great distance from the Port of Alfaques, the frontier of Catalonia is passed and the road enters Valencia, one of the ancient kingdoms of the Iberian peninsula, remarkable amongst the Mediterranean countries for its fertility, its delightful climate, and the character of its vegetation. It possesses a coast-line of about sixty-five miles, of which a part consists of rich alluvial plains watered by ingenious contrivances of various kinds, and it is thus enabled to yield the most abundant and frequent returns for the labour of the agriculturist. Of the crops, that of rice is the grand staple, and the produce is in some places extraordinary; but where this is the case, miasma and ague, the natural accompaniments of abundant fertility in hot moist climates, are too apt to make their appearance. Away from the marshes, whether natural or artificial, the climate is delicious and perfectly healthy; never

cold, and rarely so hot as to be oppressive and painful. Palms grow luxuriantly, the aloe and the cactus are in every hedge, and the orange and lemon are found in the gardens.

The towns along the coast between Amposta and Valencia are few in number,—amounting to five or six, and only noticeable on account of the ruinous state of their old defences and the apparent poverty and wretched condition of their inhabitants. This appearance is, however, rather deceptive. Although poor, the Valencians are gay and happy, and with a very moderate amount of labour obtain sufficient food of a simple kind, while the sky or a bare shed is all that is required for lodging. Rain and cold can hardly be said to exist, for they never last long enough to be troublesome. The heat of the sun also, though extremely fierce in summer, is deliciously tempered by the morning and evening breezes, and winter cold is unknown.

The hills crossed on the road to Valencia (the Peña Golosa range) do not attain to great height, but offer some pleasing scenery. Here, as elsewhere along the Spanish coast of the Mediterranean, the condition of the gravel, which abounds in so many places and is of great thickness, appears to render probable a gradual elevation of the whole district within the recent period, and the result of this has been to produce a kind of terrace nearly parallel with the present shore, and of no great elevation.

The vines of this district are remarkable for the strong dark red wines made of their grapes. The flavour of these wines is by no means agreeable, but they are richly coloured and heady, and are said to be greatly used in concocting Port wines for the English market. It is lamentable to see a district so eminently calculated to yield the best supplies, both in quality and quantity, of numerous natural and manufactured products of great value, almost neglectful of this source of wealth, careless of improvement, and inhabited by a race of peasants, who, though both physically and intellectually well-developed, at present only care to find food from day to day. The raisins, or dried grapes, and the figs are neglected like the wine. The former are coarsely and rapidly dried after exposure to a ley, and are therefore chiefly of value for puddings and inferior purposes. I have not, however, seen finer-flavoured or better-grown grapes, and there is nowhere a more steady and burning sun to prepare them for the market; the figs are also most delicious.

The latter part of the road, within a few leagues of Valencia, is at present, and has evidently long been, in a most wretched state. Covered thickly with white powdery dust, full of irregularities, and constantly laid bare to the foundation stones or the solid rock, the roads are everywhere detestable, and the diligence jolts and drags along, now brought to a sudden standstill by some more than usually hopeless portion, now tearing on through clouds of dust for a short distance, and occasionally taking as it were a fresh start, and vainly endeavouring to improve the pace and enter towns and villages with some *éclat*. At last the City of the Cid—as Valencia is sometimes fondly called—becomes distinctly visible before us, the brightly tinted tiles of some cupolas, the elegant square towers of a few of the churches, and some other more prominent objects being mixed with a few lofty palms, which here grow to a great height in the gardens. These are seen on the other side of a broad but nearly dry water-course spanned by numerous long and fine bridges, which in summer are rather viaducts. We soon enter the streets, which are narrow, short, and intricate to a degree hardly imaginable by one accustomed only to northern cities. Odd angular little spaces with all sorts and numbers of corners are passed as we wind along towards the post-office and hotel, until at length we find ourselves deposited in the cleanest and most comfortable rooms that we have seen since we entered Spain. We have reached our quarters in the *Fonda del Cid*.

Valencia abounds with objects of interest. The cathedral and other churches are not fine, in an architectural sense, nor are they very picturesque, but they contain some noble works of art of the Valencian school, nowhere else to be studied. The streets are certainly neither well-constructed nor filled with gay shops, but they include some that have undergone little if any change since the Moor reigned here supreme; while there are also some few really good buildings, and there is a general aspect reminding one of the East in everything around. Within the houses the floors are generally paved with a peculiar kind of glazed tiles, made near Valencia, and celebrated throughout Spain under the name of *azulejos*. Samples of these were exhibited in London at the Great Exhibition of 1851, and attracted some attention. Here they are universal, and the patterns are original and good. Broad expanses of dead wall, broken here and there only by

small windows; balconied windows covered with mats and curtains of all kinds; shutters closely shut during the day, to keep out the sun; streets constantly kept wet, to cool the air; innumerable beggars, including all conceivable objects of horror to excite the sympathy of the passer-by; these are amongst the things that first strike one, and explain the cause of that sensation of novelty which seemed hardly justified by the presence of anything that we had really not seen before.

Of the public buildings of Valencia, the Silk Hall, or Chamber of Commerce, is a place where vast quantities of raw and manufactured silk made in the country change hands, various times before the material finally reaches the exporter or tradesman. The building is an exquisite specimen of the Moresque Gothic style that prevailed immediately after the departure of the Moors from this part of Spain. It was completed in 1482. It consists of an open hall of admirable proportions, with a good vaulted roof, supported by curious but very beautiful spiral columns. The windows are rather large and in Gothic style, but much mutilated. The outside is fine, but has a flat appearance, hardly relieved by the decorative work above. The hall measures 121 feet by 70, and is entered by four handsome doorways. There is a pretty garden adjoining, in which are other remains of Gothic architecture.

The *Audiencia*, or Palace of the Court of Law, is a solidly constructed and handsome building, containing some interesting pictures, and one room, the great saloon, extremely remarkable for its rich panneled ceiling, gallery, balustrade, and cornice, all in the very choicest style of wood-carving. All the rooms used as separate courts are handsome, and contain many works of art, including some pictures by Ribalta, and some once curious frescos, now unfortunately daubed over with oil.

The collection of pictures in the museum possesses much interest, and being purely national—almost confined, indeed, to the works of Valencian artists—it has a peculiar claim to notice. The great masters of this school are Juanes, Ribalta, and Ribera (Spagnoletto), the two former being as superior to the latter (who was a pupil of Ribalta) as they are less known to the world than that artist. The very names of these painters are hardly mentioned away from their country, but they were, notwithstanding, of the very highest order of merit, and several

T. Picken's lith.

Day & Son Lith.rs to the Queen.

MARKET PLACE (EL MERCADO) AND THE SILK HALL — VALENCIA.

pictures by them in this collection would occupy the front rank, if placed in order of merit, in most of the museums of northern Europe.

In the smallest room of the museum are the gems of these artists. One group of five occupies the centre of one side, and includes four pictures by Juanes and one (the central) by Ribalta. Nowhere can be seen better specimens of their class than these pictures afford, but neither painters nor pictures are at all of equal merit. Juanes (born 1523, died 1579) is sometimes called the Spanish Raphael, and combines great beauty and delicacy of touch with accurate drawing and very charming colouring. This is especially seen in an Ecce Homo, where the expression of patient suffering is as perfect as the absence of any disagreeable or revolting manifestation of pain is admirably contrived. A small Assumption of the Virgin, placed as a pendant, is not less pleasing, from its simple and natural treatment, and the great softness and beauty combined with much expression manifested in it. The face of the Virgin is exquisitely delicate, and not without intellect, but is all purity and affection. A small and very highly finished picture of the Coronation of a Virgin Saint (St. Catherine) by the three Persons of the Trinity, by Ribalta, is a most interesting and beautiful example of the powers of this great artist, being equally remarkable for accurate drawing, artistic treatment and admirable colouring. Contrasted with the large and exceedingly grand pictures of the same master, of which many specimens are before us, this small and elaborate work is of peculiar interest.

Two pictures of Christ holding the consecrated wafer (*hoc est enim corpus meum*) are well worthy of notice amongst the works of Juanes. They are similar in treatment and size, and almost equally beautiful, but not copies. The calm, dignified, divine expression is as unlike the eclectic treatment of the subject common among the later Italian artists, as it is in accordance with the ideas which naturally suggest themselves. Juanes was unquestionably a great master, and worthy of a great people.

Ribalta is usually far more severe, and his colouring colder and less harmonious. His Dead Christs, Crucifixions, and other similar subjects, of which there are several in this collection, are without exception nobly and grandly conceived, and in many cases most successfully executed, but they want the warm flesh

tint which gives life and reality; and even when the subject represents death, as is often the case, the effect of his colouring is much more ghastly and painful than is really necessary. Still, no one can examine and study the pictures of this artist without being carried away for the time by the power of his genius. The works of his celebrated pupil Josef Ribera (Spagnoletto) are inferior in all respects, and always exaggerated, but from being widely spread throughout Europe, the artist is better known. Ribera generally owes his greatest excellences to his master, but has taken yet more gloomy and harsher subjects for his pencil. Ribalta's pictures are still chiefly at Valencia, either in the museums or in churches, but many are at Madrid. Few have been conveyed out of Spain either by purchase or robbery.

The churches of Valencia contain many very excellent pictures by local masters, and the cathedral has also some fine Florentine pictures attributed to Leonardo da Vinci. The singular gloom of these buildings, although favourable to the general effect of Gothic architecture and the ceremonies of the Roman Church, is not calculated to display the beauties of good pictures so much as to conceal the faults of bad ones, but still the difference between good and bad is sufficiently discernible, and is rendered more so by the usual mediocrity of those that occupy the high places. One of the churches, that of the College of Corpus Christi, contains a large number of works by Ribalta, many of them of singular merit, but it is almost impossible to examine them, owing to the extreme gloom. Every Friday morning a service is performed here, very remarkable for dramatic effect, and very highly spoken of in Mr. Ford's Handbook of Spain. The *miserere* is certainly beautiful, but the withdrawal of the altar-piece and display of a large crucifix did not strike me as so effective as I had expected. Perhaps the having read the description beforehand took off some of the effect. The crucifix itself with the Christ, which is of the full size of life, is very highly spoken of as a work of art, but is far too much concealed to be judged of from the body of the church.

There are pleasant public walks, called *Glorietta*, just within the walls of the city, but the most delightful are outside the town, and extend for some distance on the banks of the river. These are known by the Arabic name of *Alameda*. The river, indeed, is generally without water in summer, and its dry course

adds nothing to the beauty; but there is water in the gardens, and trees and flowers form an agreeable and even delightful promenade, the more so from the rarity of artificial gardens in the country. It was always pleasant to wander along in these winding paths after the sun had set, and when the heat of the day had subsided to a genial glow, not merely endurable, but positively enjoyable and refreshing. The road leads down to the sea at some little distance, but the garden portion of it does not extend very far.

Beggars abound in Valencia more than in most cities even of Spain, and they are pertinacious to such a degree, that one can only think of them in association with the mosquitos, which are equally numerous and hardly more troublesome. Every corner has its *habitués*, every church its recognised plagues of all varieties of hideous deformity, and even the principal hotels are surrounded by swarms (of beggars, if not mosquitos), who are to some extent adapted to the class of visitors that may be expected. Of all places, the little angle near the cathedral, and the Archbishop's palace, where our hotel (the Fonda del Cid) was situated, seemed to have the greatest abundance and variety, and we could rarely escape from the house without being persecuted by the very identical cases of distress which we had already seen and relieved, and which, though they had at first attracted our commiseration, soon became complete nuisances.

A fine view of the town and neighbourhood of Valencia, extending to the hills on two sides, and the island of Yviza, the smallest of the Balearic islands, seen at a distance in the blue waters of the Mediterranean, is obtained from the summit of the cathedral tower. The landscape is marked by extreme fertility within the whole of the narrow strip between the hills and the sea. Studded with pretty villas and everywhere well irrigated, there is hardly a bare or uncultivated spot within the range of view, while the town below, a labyrinth of narrow, irregular streets, with numerous towers and small domes, has a charming effect of contrast. Well might the Cid look down with triumph at his conquest, when he delivered this city from the dominion of the Moor, and gave it into the hands of the Christian monarch, whom he so nobly and disinterestedly served!

The journey from Valencia to Madrid is interesting and instructive, as giving an idea, which no description can do justice

to, of the condition of the interior of the Spanish peninsula and its inhabitants, but is eminently unsatisfactory, both to the mere traveller in search of amusement and to the lover of the picturesque; inasmuch as the pleasing objects are very few in number and very distant from each other, while the road is in many parts execrable, remaining in fact as it was in the time of the Romans, the accommodation worse than can be conceived, the rate of travelling slow, and even the best conveyance, the malleposte, not very well adapted to the comfort of the traveller, or his chance of seeing about him. There are, however, some things worth notice near Valencia, especially on the rise of the hills flanking the Cabrillas chain, where the first town, Chiva, is reached. The view hence of the plains of Valencia is most striking, and on the other side the rough scenery of the more distant hills offers a noble contrast.

Once past this range, a fine, well-watered plain is crossed, and then we enter the undulating table-land which extends with hardly any interruption for the rest of the journey. For the most part the hills are covered with gravel, which is often thick, and they consist for a long distance of hard, white, but cavernous limestone; afterwards there is some red marl. A new road is being constructed to Madrid, on part of which we travelled; but where this was not completed, the track at present followed is often only a path across naked heath. One of the characteristics of the interior of Spain is the absence of trees, which no doubt contributes to give the dismal look which makes travelling so wearisome. In many places there is ample evidence of careful cultivation, but no hedges break the weary monotony of the landscape.

At length, after occupying 40 hours in performing a journey of about the distance from London to Liverpool, the spires and roofs of Madrid came into view, and we were soon deposited safely at our hotel.

CHAPTER THE THIRD.

MADRID AND ITS MUSEUMS.

THE approaches to Madrid are peculiarly Spanish, and without the smallest resemblance to anything that is seen near other capitals. In almost every direction the country is desolate and barren—no gardens surrounding pleasant villas, no trees and picturesque spots for the people to enjoy as retreats from their town life, no water of any kind, and indeed, with the exception of dusty high roads and bare rocks, nothing whatever on which the eye can rest. The city is built on the great central plateau of the Peninsula, at an elevation of 800 varas (2225 English feet) above the sea. Seen from a distance, the mixture of pointed little spires and high roofs with lofty square-topped buildings and churches, the large spaces occupied by convents, and the mixture of old houses with new palaces, narrow alleys and broad paved streets, all combine to give a striking effect, which the costumes and manners of the people by no means diminish. The immediate entrance of the town is indeed diversified also by a few stunted, half-grown trees, forming avenues which by no means succeed in keeping off the burning heat of the sun; but everything is artificial, and the dust is so abundant, that whenever the wind blows, any kind of locomotion is on that account not only very disagreeable, but often almost impossible in the middle of the day.

We entered Madrid first by that side nearest the Prado, a public walk, which, like the Prater of Vienna, the Champs Elysées of Paris, and our Hyde Park, has acquired a European reputation. It is not very extensive nor very picturesque, though some of the museums and important public buildings, besides the botanic gardens, adjoin it and assist in rendering it cheerful and pleasant; but its gaiety at night can only be appreciated by those who have seen, and not merely read of, the habits of people in hot countries. We passed it however at very early morning, and soon turned down amongst the houses, through a street of

palaces of modern date, into the very heart of the town, where the Post Office is situated. This is called the Puerta del Sol, or Gate of the Sun, and marks the spot where the town once terminated, although no fragment of a gate, or any indication of an ancient construction, now suggests such a fact. From it, all the principal modern streets diverge, and during the afternoon it is the central point towards which every one congregates. There is here, however, little or no shelter from the rays of the sun, and thus during the glare of noon it is somewhat deserted. Indeed, there is little doing either of business or amusement at this hour of the day.

Madrid is essentially a gay city, and one in which business holds a very unimportant place compared with pleasure and intrigue. It has no commerce, no manufactures, and hardly any trade except that arising from the aggregation into one place of a large population. It has no charm of antiquity, no pretension to the picturesque in any high artistic sense; no fine churches or other ecclesiastical buildings, and very few public buildings of extraordinary merit. Yet in spite of all this it is a noble and fine city. It looks well from a distance, with its curious little oriental spires rising everywhere above the level of the houses. The Chamber of Deputies and the Palace, if not the churches, are really handsome and effective. Its public walks and gardens are among the finest in Europe; the costumes of its inhabitants are pleasing and altogether peculiar; its shops are gay and bright, if with borrowed plumes, and everything breathes an air of busy idleness, in which it will even bear comparison with the Boulevards of Paris.

It is however chiefly in the early morning and at night that Madrid life is seen. At the former hour the markets, and all places connected in any way with the only business of the capital —the supply of a very moderate share of the necessaries and luxuries of every-day life—are bustling and active to a degree exactly corresponding with the population. In the evening, on the other hand, all the rest of the inhabitants pour forth from their shops and houses where they have been dozing during the day, and crowd upon the Prado and other public walks to stroll about, sit on chairs, criticise their neighbours, drink cool water, and smoke little cigars composed of tobacco rolled up in paper. In the middle of the day, with a temperature of nearly 140°

Fahr. in the shade, and no one knows what in the sun, pitiable are those who are to be seen walking in the streets, and still more unhappy the few, who being outside one of the gates are obliged to make a circuit of part of the wretched mud walls of the city, to enter at another gate, for they will assuredly be exposed to a species of martyrdom more resembling broiling than anything else that can be mentioned. I speak in this from experience, for having but little time, and being anxious to make the most of it, I made a circuit of part of Madrid, both inside and outside the walls, between the dreaded hours of eleven A.M. and two P.M.

Still, the streets and even the churches have their charms. The view (see Frontispiece) of the street of St. Bernard and the church of the Jesuits is strikingly picturesque, and many other parts of the old town are equally so. The public buildings also are fine; the museum of pictures simple and inexpensive, but not unpleasing; the new Chamber of Deputies also in good taste and a handsome building; and the Royal Palace, if not perfect in architecture, admirably placed, and a massive pile of building worthy of being the residence of a great monarch.

No doubt there is abundance of poverty in Madrid, as in all great cities, but, except in the case of a few street beggars, it is not easily discovered, and nowhere painfully presented to the passing traveller. At the present day there is nothing, either here or in other parts of Spain where I have been, to justify the national character for gravity, for which the Spaniard has been so long and so proverbially famous. I have seldom seen a more lively, excitable race, or one more given to enjoy the passing hour, whatever the amusement or excitement may be. In this respect I feel that my experience in the country must not be put in competition with the better knowledge of residents, but I speak as I have found the people; and as I have traversed Spain in various directions, and visited all the principal provinces except those in the extreme north-west and south-west, I venture at any rate to record my impressions.

Beggars abound sufficiently in most towns of the Peninsula, and are especially troublesome to travellers by the public diligences and other conveyances. Knowing the hour at which these arrive and depart, the vicinity of the coach-office is

besieged by the lame, the halt and the blind, who not only request, but force compliance with their demands, if the tired traveller desires a few moments' quiet. Many of these, however, are real objects of charity, as there are no public establishments for their relief, and they depend for their existence on the casual help they thus obtain. One feels the less disinclined to give assistance in this case, from knowing that there is no other resource, and that the want is often real.

Madrid boasts of several public educational establishments and museums of various kinds. The public library is extensive and rich in some departments of Spanish literature. There is an armoury very remarkable for its contents, a collection of coins of great interest, and an interesting series of minerals in the School of Mines. There is also a large and interesting botanic garden on the Prado, not far from the Museum of Paintings.

Science and natural history are now, and always have been, at a low ebb amongst the Spaniards, and in spite of the great men who from time to time have arisen and have shown some appreciation of pursuits of this kind, there is little in Madrid to mark their existence or testify to any real progress. All departments of natural history have been almost equally neglected, and although the enormous mineral wealth of Spain might well have justified attention to geology and mineralogy, if only for their practical importance, yet even here we can find but little attempted and nothing really done. Thus, although public collections of zoology and mineralogy exist and are placed in a museum, it will not take long to describe those parts that are new and interesting, or peculiar to the place.

The mineralogical collection is remarkable for some noble specimens of crystallized native sulphur from Conil near Cadiz; a large series of calc spars from various places in the interior of Spain; a very interesting series of marbles, granites, serpentines, &c., from each of several provinces, those from near Tortosa and Tarragona in the east, from Granada in the south, and from near Madrid, being among the best; a remarkably fine native lodestone, weighing 6 lbs., and sustaining upwards of 60 lbs.; a fine series of gold pepites, chiefly from South America; a magnificent specimen of muriate of silver, from Guadalajara, a rich silver mining district near Madrid; and a few

fine specimens of phosphate of lead. The whole are arranged in rather an antiquated method, and the number of names and localities given is scanty. I was pleased to see a considerable number of persons examining the different objects with some apparent interest.

The collection of fossils, though not absolutely confined to one specimen, is so nearly limited to this, as to exclude the possibility of noticing a second. But the one is indeed a magnificent monster, being the celebrated *Megatherium,* the largest, and, at one time, the most perfectly preserved skeleton of an extinct animal known to exist. The bones, which are here set up in a somewhat imperfect manner, were discovered upwards of sixty years ago near Buenos Ayres, and were sent to Madrid, being explained and described afterwards by Cuvier, in his great work on Fossil Bones. The animal resembled a sloth in some of its habits, but was very much larger and more massive, though not taller than the largest known elephant. Since the closely-allied *Mylodon,* discovered near the same locality, was brought to England and set up, and described by Professor Owen, the exclusive interest attaching to the Madrid specimen is rather diminished, as no attempt has been made by the Spanish naturalists to improve the arrangement of the skeleton; but it will always remain one of the most magnificent examples of the inhabitants of the ancient world that have been handed down to us, scarcely altered by the thousands of years that have passed away since the creature was in existence in the woods of America, and employed the vast strength with which it was endowed in tearing up and pulling down the trees of the tropical forest, on whose leaves it seems to have lived.

But if the Museum of Natural History has been neglected, such is not the case with the Picture Gallery. This is indeed a treasure of the highest art, and is well worth a longer and rougher pilgrimage than that to Madrid. It contains a number of first-rate pictures by all the best known Italian and Flemish masters, the latter collected and acquired when the Spaniards were masters of the Low Countries, and the former also obtained under the most favourable circumstances. Until removed to decorate the Louvre by Napoleon and his generals, these pictures had been cherished and preserved unhurt by the Spanish monarchs, who, whatever were their follies, and however wild

and fierce their insane bigotry, were at least alive to the value and importance of the treasures of art they had possession of. But besides these grand works, Spain has had artists of her own, inferior to none in the very highest order of excellence; men of genius, originality and power, such as the world has rarely seen, and who were able to transmit to canvass all that was most noble, excellent and grand in the ancient Spanish character. Such was Velasquez, who takes rank with Raphael, Michael Angelo, and Leonardo da Vinci. Such also was Juanes; and such, though in a different way, were Murillo and Ribalta. The best works of these artists, *without exception,* and in some cases almost all their genuine pictures, were at once received into some royal or ecclesiastical edifice, whence they were only removed to be placed in the present museum at Madrid. A large number of these, as well as the finest of the Italian pictures, were among the spoil of the French conquerors of Spain, but most of them escaped, and many of those taken away have been restored. The great Spanish pictures are therefore still to be seen only by those who visit Spain, but there they may be studied, and will amply repay any amount of time and study devoted to them.

In speaking of the Valencia Museum, I have already given some account of Juanes and Ribalta, whose best pictures are in that collection. The finest Murillos are in like manner at Seville, the birthplace of the artist, but in Madrid we see to perfection the works of Velasquez. This great artist was born at Seville in 1599, studied and painted in Italy, but returned uninfluenced, so far as the smallest mannerism is concerned, from association with the bright constellation of talent that was then shedding its glory over that country. On his return to Spain he settled at Madrid, there to work out and embody his own manly ideas of art, trying every department and succeeding in all, but chiefly excelling in the delineation of *men,* in which he has been rarely approached, and never at any time or in any country excelled. Of this painter upwards of sixty pictures are in the Madrid Museum, and none are without some points of interest, few are in any sense second-rate, while most of them exhibit the power and genius of the artist in a manner which cannot be mistaken.

The portraits of the ruling members of the house of Austria, and of their wives, children, favourites and generals, a few other portraits, one or two battle-pieces, one or two landscapes, and

some sacred subjects, make up almost the whole series of the works of this master presented to us. Each class possesses beauties and charms of its own, and each is altogether different from the others. In the portraits, the thing most remarkable is the perfect individuality and honesty of the painter. The likeness one cannot question, for the very face is in each case flesh and blood before us. No attempt at improving ugliness or heightening beauty is to be traced, but at the same time there is never any unnecessary or painful object introduced. The dignity of art is upheld, without the truth of nature being in any case for a moment sacrificed. One portrait of Ferdinand of Austria, which has been engraved, and is not unknown in this country, affords a good instance of this peculiar character of the artist. The man and his dog stand out boldly from the canvass before us. Landseer never painted a dog more faithfully or more carefully—his eye is on his master, and he is ready at a moment. The prince is dressed very soberly, but the colouring is finished with admirable care; nothing, however, distracts the attention from the face, which is calm, natural and pleasing. A considerable number of similarly treated subjects might be referred to. All are true and genuine. Without false glare, without any attempt to shine, they represent exactly what is required and no more, and this they do freely, firmly and distinctly. It is said that no sketches of this artist are known to exist, and that he actually *drew* upon the canvass, and the appearance of the pictures fully justifies this. The colouring at first appears cold and grey, but it improves wonderfully on becoming accustomed to it; and all the details are so perfect, the aërial perspective and chiaro oscuro so faultless, that, like nature itself, the beauty of the image is not seen or appreciated till it has been looked at over and over again. Then by degrees the whole comes out and harmonizes, until the actual creation of the object is attained.

Besides the royal family of Spain, there are numerous portraits by Velasquez of the dwarfs, who seem to have been kept about the court for the amusement of children of all ages. Such objects are difficult for an artist to do justice to, for in themselves they excite painful ideas, and these are too apt to become ludicrous when the smallest approach to caricature is permitted. Such an approach, however, is never seen in Velasquez. The dwarfs are dwarfs, and nothing else. They are true representations of natural

objects, though unlike their kind, and thus they become really interesting in a natural-history sense.

So also with children. The child-like character is manifest in all, but some of the children are bright and clever, some are dull and stupid, and this always in a perfectly true and natural way. There are one or two portraits of this kind perfectly marvellous in the effect they produce when examined carefully.

The sacred subjects are not numerous, but there is one—a Crucifixion—which seemed to me the grandest and most sublime realization of the event that human intellect could conceive, or human hand represent. The darkness has covered the earth and the Christ is dead, but the expression of resignation and suffering still remaining in the drooping head can never be effaced from my memory.

All the works of Velasquez are thinly painted, and little if at all varnished. They have been honestly and carefully finished, and the artist has evidently been more desirous to work up to his own standard of perfection, than to satisfy any fashion of the day. He is not gloomy in his treatment even of sacred subjects, and in this respect both he and Murillo are striking and noble exceptions to the prevalent austerity of the Spanish school, which was too apt to be governed by the dread of the Inquisition. No one certainly can see and examine Velasquez' works without understanding the simple, unassuming, but unyielding character of the man himself, who stands now on a proud eminence rarely approached, and whose influence is felt and acknowledged by all great artists who have studied him in this place*.

The works of Murillo are so very much better known than those of Velasquez, that it is altogether unnecessary to dwell

* It is with no desire to disparage the high reputation of some modern artists of great eminence, as well as some of more ancient date, that I venture to remark how much their individual styles and habits of treating serious subjects have been sometimes modified and permanently changed by the study of Velasquez, in the Madrid collection. It is to be regretted, however, that the majestic intellect and genius of the Spanish master have produced, in these cases, a certain amount of imitation and restraint not favourable to the full play of the natural powers and imagination of the student whose style was already formed. The style of Velasquez is so exalted, so simple, so original, so free from all incidental aids to produce effect, that when a less perfect hand attempts to imitate, the result is a certain degree of baldness and hardness without grandeur.

long on his peculiarities of style and peculiar excellences. Still, Murillo cannot be fitly studied or fully understood from those pictures only which have reached foreign collections. Without the independence and originality of his great countryman, his genius led him to select a style and mode of treatment which are varied, charming, and always pleasing; and those works emphatically his own will always be acknowledged as among the most interesting to the mass of spectators that have ever been produced. Unlike Velasquez, however, he was impressible, and changed his manner more than once, so that it requires a little consideration before one can feel perfectly satisfied how far the subjects he painted are really his own.

Till lately, Murillo was chiefly known in England as a painter of picturesque groups of Spanish boys eating fruit. His remarkable altar-pieces and other sacred subjects, of which the number is very large, and the variety extremely great, are now indeed rather more widely distributed, but are still hardly appreciated, and it requires, as I have said, that he also should be studied in Spain, if his true merits and demerits are to be felt and understood.

The great fault in almost all the works of this great master is want of dignity, so that in his sacred subjects, his infant Christs are but little children, and his Virgins beautiful girls. The beauties are, however, so numerous and so considerable, that they deserve careful notice. His colouring has a charm rarely attained by any artist, both flesh and drapery being boldly, firmly, and most successfully treated, and the result showing itself in a class of pictures, which are, perhaps more than any others, *pleasing*. Several of the pictures in the Madrid Gallery are remarkable instances of his success in this way. One, *la Purísima Concepcion* (the Conception of the Virgin*), is perfectly marvellous for the exquisite purity, sweetness and delicacy of the principal figure, the harmonious and yet brilliant colouring of the drapery, the thin, clear, warm atmosphere of the heavens, and the sweet figures of the angels and cherubs that are floating at the feet of Mary, —though she herself also floats in the air, without its being

* The number of repetitions of this subject by Murillo is very remarkable, but although generally treated in the same style and with very similar feeling, they are in no sense copies of one another. The fine picture here alluded to is one of several (No. 229 of the Catalogue) in this collection.

possible to find fault with the incongruity. Many other pictures of this style are here, and they are all worthy of examination.

Another class of subjects by Murillo is more severe, partaking in some respects of the manner of Velasquez, and consisting of figures of saints. The portrait of St. James (No. 189) is a good example of this style. This fine picture is somewhat gloomy for Murillo, but is noble and even pleasing notwithstanding. There is more dignity than is often seen in his works, and it has even been said that the treatment is coarse, but it is on the whole a wonderful picture, and highly interesting as illustrating the powers of the artist. Many of the Murillos in the Madrid Gallery are already well known by engravings, but, I believe, the St. James is little if at all known in England.

While the masters of the Spanish school are thus nobly represented, the Madrid Gallery has also been enriched by the possession of some of the priceless gems of Italian art;—I say, it has been so enriched, but, alas! although the names remain in many cases, the realities are now lost for ever. Two of Raphael's best pictures, the *Madonna del Pesce* and the *Perla*, or Pearl, were amongst those removed to Paris, and being there were exposed to the most exaggerated form of that process called cleaning and renovating, by which, and by some subsequent treatment, it is not too much to say that these magnificent works have been totally and hopelessly spoilt. They are now bright, glaring, and hard; the aërial perspective and chiaro oscuro in many places absolutely destroyed, probably by repainting, and the first effect to the eye is that of hard wiry copies. On looking into them, the hand of the divine master is recognizable, but the charm of the picture is gone. One hardly knows whether to be more grieved at the irreparable loss, or indignant at the atrocious folly which could risk the destruction of such treasures for the chance of making the colouring brighter, and restoring that freshness which can hardly re-appear to advantage on a painting that has once lost it.

Next to Raphael, the works of Titian are the finest of the Italian school in the Madrid Gallery, and many of them are of the very highest order, admirably illustrating the wonderful power which this great painter possessed of delineating human flesh. There are no less than forty-three pictures by Titian in the museum. Some exceedingly fine pictures by Rubens, Vandyke,

and other Flemish masters are also in the collection, and few are second-rate; but I must not dwell on their excellences, as far more able critics have already so frequently expressed their opinions, and most of the artists have admirable illustrations in our own country. I feel, indeed, that some apology is due for venturing to say so much as I have done in the preceding pages, and can only plead a desire to induce others to pursue the same course, and obtain a personal knowledge of these marvels of pictorial art to be seen only in a city and country too seldom visited by British travellers. For the same reason I do not attempt to describe other collections of pictures in Madrid, of which there are several in no way remarkable in any national sense, although perhaps not unworthy of special description for the foreign works they contain.

The arrangement of the pictures in the gallery, and the light, especially in the newer part of the building, are extremely good. At one extremity of this room are brought together many of the finest pictures of various masters, native and foreign, and probably nowhere can a more grand or interesting group be seen. Here we may judge of and compare the merits and demerits of the Spanish and Italian schools, and observe their mutual influence and the extent to which the genius of the earlier has modified the works of the later masters.

I could not be at Madrid without being anxious to see a bull-fight, and thus judge for myself of the real nature and extent of the excitement produced by this last and singular remains of the amusements of a former time, when education and civilization had not softened the national character of the rest of Europe, and when bull-fights were well represented amongst our ancestors, by cock-fights, bear-baiting, dog-fights, and other similar exhibitions, at least equal in barbarity and barbarism to the peculiar glory of Spain—its *tauro-machia*.

It happened that on the very day of my first entrance to the capital, a solemnity of this kind was about to take place. I procured a ticket for a good place in the shade, and at the proper time (four P.M., when the intense heat of the sun was abating) proceeded to take my seat. The whole of the noble street leading to the principal gate, outside which is the amphitheatre, was crowded with people of all classes, anxiously bending their steps to the one great centre of attraction. Omnibuses, crowded

inside and out, and drawn along at full gallop by six horses—carriages of all kinds, from the britschska of the nobleman to the shabbiest of shabby cabs—and foot-passengers innumerable, completely filled the broad pathway. All the lower classes were in full costume, some of them being mounted on horses, whose scarlet housings were really magnificent: and the general effect of this part of the population, with a large sprinkling of water-sellers, fan-dealers (for everybody, male as well as female, takes a fan to the battle-field), cigar-lighters, and numerous others, following in their wake, and screaming their occupations at the top of their voices, produced a scene quite as exciting as any ordinary public amusement could be.

The appearance within the amphitheatre was extremely fine. The building itself measures about 600 feet in diameter, and holds when crowded at least 8000 people. When I entered, it was nearly full. Near the ground the mass of people were already seated, in all varieties of Spanish costume, both male and female, but the waving of fans almost obscured the details. Higher up, and in the boxes, the dresses were more gay and rich, but less picturesque. The central area, open to the day, was occupied by boys and stragglers, who, at a signal, were soon dispersed; and a procession, consisting of about twenty men-at-arms on horseback, and headed by two men in full Castilian costume, paraded round the course. These were followed by a number of others, in the gayest spangled dresses, in regular order, whose business it is to excite and tease the bull, by holding out cloaks of the brightest colours, and then running away, inducing the bull to follow. These are called *capeas*, and escape when pursued by jumping over a strong barricade into a recess, where it is very rarely that the bull can follow them. Then came five men on horseback, in full black dress; afterwards six *picadors*, each armed with a spear, and padded so as to be safe from ordinary accidents; then a number of led horses, harnessed in threes, whose business it is to carry off the dead animals; next, ten men in a blue dress; and last of all, a number of men leading bull-dogs, the last resource when a bull refuses to show fight, and is not thought worthy of being killed by the sword.

All these at first merely pass in review and then leave, except two of the picadors and a number of the capeas, dressed in

bright colours, with their cloaks on their arms; and the door is immediately opened for the bull to rush out.

It may well be imagined that very great difference will exist in the mode in which these animals behave when thus admitted into an open space, perplexed by a multitude of enemies close at hand, surrounded by a vast concourse of people shouting at the utmost pitch of their voices, and with a military band playing martial airs close to them. To watch this first impression was both interesting and exciting. The first bull on the present occasion, bred near Madrid, was bold as well as fierce. He charged the picador, who met him bravely with the lance, but the horns of the animal tore open the horse's belly; and although he again and several times withstood a similar charge, the man was at last thrown and the poor horse killed. Meanwhile the capeas were not idle, but worried and teased their victim till he was nearly exhausted.

A new set of tormentors, the *bandarillos*, then entered with darts covered with paper flounces, each dart having a sharp barbed point; and these were very cleverly stuck into the animal's neck, and infuriated him once more. The *espada*, or swordsman, at length appeared—his hair curiously knotted behind like that of a woman, and his whole appearance rather effeminate; standing in front of the bull, he dared him to the charge—exciting him with a scarlet cloth. While being rushed at, however, the espada steps adroitly aside, and plunges his long sword into the neck of the animal towards the heart. When the bull is dead, the horses that have been killed are first carried out by the team already described, and then the carcase of the bull is conveyed off in the same way at full gallop, the band playing a triumphant air in honour of the victory.

Such, with certain exceptions, is the march of events in those cases in which the bull is staunch, and the men well-experienced. If, however, the bull is not sufficiently courageous, and will not charge the mounted picador, dogs (*"los perros"*) are loudly called for by the spectators, and are soon brought in, and allowed to worry the animal.

The breed of bull-dogs used for this purpose did not seem to me particularly fine, but they soon succeeded in their object, although, in one case, not without some mischief being effected, and one poor dog killed.

Of the eight bulls brought out on the occasion in which I was a spectator, only one was really powerful, fierce, and determined; and the combat in his case had much that was grand and even terrible. He was bred in Seville—a black and white animal, with large spreading horns and a noble head. He fought with every enemy that presented himself, never refusing to attack. He killed four horses and mortally wounded two others, being himself killed at length by two stabs, fighting to the last, and rushing at the espada, after he had received one sword-thrust to the hilt, with almost as much vigour as if the battle had only just commenced.

One other, a black bull, also from Seville, showed much fight, and killed three horses, but was not so determined as the last. The rest were far inferior, one of them refusing even to attack the unarmed men, and being easily killed by three dogs.

Certainly there must be an element of savage nature in the heart of most men, to enjoy a scene like that I have just narrated; and, although I do not believe I am more bloody-minded than my neighbours, I must confess to a feeling of excitement, not unmingled with pleasure, while the scene was being enacted. The attitudes of the bull are, many of them, extremely fine, especially when in the act of preparing to attack; while the calm resolution of the picador or espada, with his eye fixed upon the animal, ready to receive him and prepared for any emergency—the cool daring with which he steps aside to avoid a danger he cannot meet, and is again prepared, if necessary, for another attack—the rapid movements of the capeas, with their cloaks playing about in the air—all these, combined with the intensity of interest felt by all around, marked occasionally by the unanimous rise of a whole side of the amphitheatre to obtain a better view of some passing event, communicate even to the most unimpassioned some glow of excitement, however opposed to his better judgment.

But the effect of all this must be bad. To see a gentle-looking creature, all delicacy and kindness at another time, calmly look on on an occasion of this kind, and even laugh, instead of shudder, as some unfortunate horse is actually disemboweled by a sharp stroke from the horn of the maddened bull—to see the same woman (can we use the term ?) wave a handkerchief, and become wildly excited when the death-blow is given, and

the blood pours forth in dark streams upon the ground, regarding the whole with the cheek flushed and the eye fixed as if she herself would willingly be the butcher—these are scenes which one had rather not witness, but which seem the natural results of this national sport. I would not judge harshly in a case like this, but it is difficult to persuade oneself that other than evil can arise from such an education.

And the effect on the Spanish nation is apparently what might be expected. Accustomed to the sight of blood in their amusements, they think little of shedding it in reality. It makes them cruel rather than brave, and more apt to commit murder than to fight. That this is the case, all their history has shown; and, however for the moment the condition of the people may seem improved, and tending towards progress in the arts of civilization, those who know most of the Spaniards are least hopeful in regard to any permanent alteration in those manners and peculiarities which stand in the way of real advance. I am far, indeed, from suggesting that bull-fights are the cause of this; they are amongst the remains of an age rapidly passing away, and rather proofs of the existence of the feelings of an earlier period, than the causes of such feelings at present. They are, however, so necessary to a Spaniard's existence, that the race itself must probably be in some measure remodelled, in order that the gradual abolition of the national amusement may arise from altered sentiments among the people themselves.

CHAPTER THE FOURTH.

THE CENTRAL PLATEAU AND NATURAL PASSES OF SPAIN. A VISIT TO GRANADA AND THE ALHAMBRA.

From Madrid, as a starting-point, it will be instructive to consider the aspect of the interior of Spain, first in its northern extension across the granite and limestone ridges separating the lofty central plateau of table-land from the Pyrenees, and afterwards across the somewhat similar line of broken country forming towards the south another intermediate ridge, terminated by the lofty mountains of the Sierra Nevada and several sierras of less elevation separating the table-land from the Mediterranean. There is a considerable amount of resemblance in the general features in these two great barriers of Spain. Both are naturally almost impregnable; both are double, and both are terminated by very lofty mountains. They differ indeed greatly in details; but as the one separates old Spain from France, and the other from Andalusia, we find that the national character is changed in a somewhat similar manner on the northern and southern sides of the passes, and that the central plains are thus terminated in each direction by natural landmarks that affect the human race as well as inanimate nature.

The high plateau of central Spain is everywhere nearly the same, except where broken by mountain chains. Towards the west, however, and also towards the north-east from Madrid, considerable elevations containing much mineral wealth are known to occur, while towards the south-east the edge of the table-land is comparatively little elevated. Without further preface I now proceed to a short description of the physical features of the country between Madrid and the Pyrenean chain, including an account of the pass on the western side of that chain, which may be compared with the description already given in a former chapter of the eastern pass by Figueiras.

Once out of the mud walls which enclose the town, and both Madrid and its population cease to exist. A very few miles are enough to detach us entirely from the busy scene, and place us

in what is almost a desert. This lasts, however, only for a few miles, and the traveller on the high road towards France soon meets with objects of deep interest. Immediately around the capital there are, it is true, few objects of interest of any kind, but very soon the serrated ridge of a picturesque and noble mountain-chain—the Somo-sierra—rises up like a wall before us, and on a nearer approach an almost vertical mass of granite is seen stretching out, barring the way northwards and frowning defiance to the approaching traveller. The whole forms a narrow but broken ridge of decomposing rock, vast masses being thrown about in every direction, huge flat blocks and smaller boulders covering the adjacent plains, rounded piles heaped together in confusion, and the surface of the whole neighbouring district entirely derived from this one source. Seen from whatever point, the view of this fine Sierra is grand and striking, while occasionally, where the decomposition of the granite is most complete, a rich vegetation of trees may be observed, especially where from any accident water is retained near the surface.

When past this range the face of the country changes considerably, and a broad tract intervenes, chiefly of undulating ground, occupying the space between the granitic Sierra and another range at some distance, which forms the southern boundary of the valley of the Douro. Everywhere across this tract the scenery is marked and grand. It is not indeed highly cultivated, rich, or in the ordinary sense "pretty" scenery, but it is much more than this, and I cannot but pity the traveller who can pass over such a district and speak of it as "a hideous country," undeserving of another word. It appeared to me to be a magnificent mountain-track, excelled by few in its own peculiar style of grandeur, and characteristic in the highest degree of the remarkable physical geography of the Iberian Peninsula. Let no one, therefore, be deterred from visiting Spain by the dread of the long journey back from the capital of the country to the frontier of France. The journey is not only a fit and instructive introduction to the district, but it abounds in objects of interest to the lover of nature and fine scenery, and nowhere more so than in that so-called hideous portion between the Somo-sierra and the Douro *.

* Like many other kinds of scenery, the effect is much dependent on the order in which it is taken. The journey from Madrid to Bayonne is

The descent into and view of the valley of the Douro is very beautiful and rural. Considerable masses of gravel, often of very great thickness and forming hills of a marked character, here intervene, and show a comparatively recent elevation of the whole of this part of the Peninsula, while the effects of water in removing large portions of similar accumulations once existing are no less strongly indicated.

The country between Aranda, on the Douro, and Burgos we passed in the night, and it did not appear to be so interesting as the earlier part of the route. Burgos itself is a fine venerable-looking Gothic city, with a cathedral whose exterior is of the richest and most florid character. It is indeed considered to be one of the finest cathedrals in Spain, and the exquisite finish of the open stonework, as well as the general composition of the grand or west front, fully justify that reputation. The interior, however, with the exception of a noble octagon tower rising 180 feet from circular buttresses, between the choir, nave and transepts, is of rather too mixed a style, and too much loaded with decoration to be altogether pleasing. There is too, unfortunately, a vast deal of modern work overlaying the fine Gothic, and injuring the effect. Still, it is rarely that one sees so grand a specimen of human labour, and the picturesque unevenness of the ground on all sides greatly adds to the effect. The cloisters are fine, and also on irregular ground.

Towering above the cathedral and town is the fine old castle of Burgos, celebrated in ancient Spanish history, and memorable also amongst the localities that have shed such glory on our own great hero of the Peninsula. Large portions of the old walls of the town still remain on the river front, but on other sides these are now destroyed.

From Burgos the road proceeds across a second principal range separating the waters of the Douro from those of the Ebro, and is interesting from the contrast of forms and resulting structure of the country when compared with the granite ridge of the Somo-sierra. Here the rock is limestone and is cleft in

far more interesting than that from Bayonne to Madrid, arising partly from the gradual increase of interest felt in the former case in approaching instead of receding from the chief mountain-chain, and the higher style of cultivation, and partly from the fact that the various points of interest really look best when seen and approached from the south.

various ways, but chiefly so as to leave one narrow defile through which the road is made to pass, and which is rarely equalled for boldness, natural strength, and picturesque beauty. The jagged forms here shown are far more square than those of the granite, which are serrated like the teeth of a comb; the clefts are far deeper, and the pass is singularly direct and level. Up to the moment of entering it there seems no possible way of advancing, so steep and abruptly do the rocks rise. When we have traversed it also the character of the scenery is completely changed, and a smiling beautiful country succeeds to the somewhat rough and gloomy scenery on the southern side. This pass of Pancormo forms another of those strongholds which the Spaniards possess, and of which they seem to have made so little use in the war when the French first took possession of the Peninsula under Bonaparte. In former times, however, it served as a permanent defence against the Moors, who never advanced beyond it.

The upper valley of the Ebro is entered when this defile is passed, and the distant Pyrenees are now seen rising nobly before us. Passing through the town of Vittoria, so memorable for the utter defeat of the French on the 21st of June, 1813, when they were finally driven out of the Peninsula, the road soon enters a hilly country, prettily covered with houses and villages, and for the most part well-cultivated, forming a part of the Basque provinces, remarkable as containing a peculiar population, quite distinct from any other, either of France or Spain. The villages become more numerous, cleaner, and larger; the people are a finer and better developed race; the farms are better cultivated, and a general air of neatness prevails quite unknown in the two Castilles. The aspect of the people and country reminded me of some parts of Cornwall and Wales, and the peculiar dress of the people—the women wearing a round hat as in Wales—assisted, no doubt, in this resemblance. Before long the country becomes more bold, and the first flanking range of the Pyrenees is crossed. We then immediately enter the mountains, and after rising for a time descend suddenly a magnificent mountain gorge clothed with the richest verdure, both of wooded and cultivated land, while several villages and detached farms contribute to render the scene more picturesque. I have seldom met with anything either in Switzerland or the Tyrol more pleasing than this

mountain-road, and seen as it was in a half-light near sunset, with the darkness of advancing night keeping some parts in the deepest shadow, while the tints of the setting sun brightened and enlivened other portions, it presented a rich contrast, occasionally heightened by the lights in the villages far below our feet, the whole being in the highest degree picturesque, and a fit introduction to that mountain-chain which we now entered in earnest, and which forms so important a physical boundary between lands geographically adjacent. The rest of the Pyrenean chain traversed between this first entrance and the gates of San Sebastian we passed by night, and with a somewhat thick mist covering the ground. I believe however it is not, on the whole, so fine as the first portion on the Spanish side *.

We reached San Sebastian about 5 A.M., just before sunrise, and there remained some time. This most beautifully-placed town, crowned by its fortress, appears to rise out of the sea, and as it really forms an island at low water, the appearance is hardly deceptive. Most of the streets are new, and the town altogether is neat and regular; but the chief charm is in the surrounding country and the port, which are singularly pleasing and cheerful. The hills are wooded quite to the water's edge; the deep indentations, partially occupied by fresh water, but affected by tidal influence, are fringed by pretty villages, and the whole country is well-wooded. The road out of San Sebastian is extremely pleasing, and the same style of scenery continues as far as the town of Irun, and the banks of the small stream, the Bidassoa, which separates Spain from France. In spite of the terrible account given of the frontier Spanish towns in Mr. Ford's Handbook, whose authority it is dangerous to contest, I must venture to record my opinion that Irun is a clean-looking, interesting town, full of cheerful, pleasant people, and that the Spanish officials on this frontier are like those I have seen elsewhere, perfectly well-behaved, and not at all troublesome, even when they are not propitiated by that bribe which is so strongly recommended.

The frontier between Spain and France is passed on crossing a bridge over the Bidassoa, near a point celebrated at the close

* This part of the road, which I have since crossed by daylight, does not in fact afford much that is worthy of notice, though certainly pleasing and picturesque.

T. Picken. sc.

Day & Son, Lith.rs to the Queen.

SAN SEBASTIAN — THE HARBOUR & FORTRESS.

of the Peninsular War, as the scene of a brilliant and successful *passage* by the troops under the command of the Duke of Wellington, in the face of numerous strong fortifications carefully prepared by the French, and in spite of an army stationed in great force to oppose them. The view of the two countries, France and Spain, as seen from the bridge, is very beautiful, and includes a considerable extent of hilly picturesque landscape; but the Spanish side is the more varied, broken and interesting, on account of the greater extent of cliff and hill in sight, and the number of houses and villages dotted about. The view from Irun, indeed, includes Fontarabia and the open sea, while that from the bridge takes in only one reach of the river, terminating at Irun; but the latter is also extremely interesting and pleasing.

On entering France, although we still continue in the Basque country, which is so peculiar both in the language and appearance of its inhabitants, there is yet a very marked difference to be observed. Even in the first small village of Behobia, a French appearance may be traced, and as we get on, the towns become neater, the people more business-like and active, the cultivation more decided, and trees begin to show themselves as the result of planting as well as by accident. The little town of St. Jean de Luz is a good instance of the change. It is of considerable antiquity, but the houses are white and the streets straight. The costumes of the people are here very peculiar, and the fisherwomen are especially worthy of notice. A group of them is shown in the accompanying woodcut (fig. 8). These dresses are quite distinct from any costumes of the North of Spain, and the character of the people is not less so.

As we rise from the river and advance towards Bidart, the country is highly picturesque, some hills at the time of our visit being covered with the most beautiful heaths in full blossom, mixed with numerous aromatic herbs scenting the air to a great distance, while others were cultivated; vines, maize-fields, and other produce giving a rich appearance to the landscape, without introducing formality. Hence to Bayonne the road is less hilly, but always varied and pleasing, and before the town is entered a number of good houses are passed in the outskirts, —a feature sufficiently marking the change of country, as in Spain it is very rare, except on the east coast, to find even a

single habitation outside the magic ceinture, often hardly even a mud wall, which encloses the town.

Fig. 8.—*Costume of Fisherwomen, St. Jean de Luz.*

Such is an account of the country connecting the great table-land of Spain with the range of mountains which separates it from the much lower plains of Languedoc and Gascony. It should, however, be observed that this statement was drawn up immediately after my first visit to the country, when the very fact of the absence of all ordinary elements of the beautiful becomes of itself a sort of beauty, if only from novelty. It must also be borne in mind that the journey from Madrid northwards, starting from a dreary desert, and gradually entering mountain defiles and crossing a great mountain-chain, possesses an interest very different from, and much greater than, that experienced in advancing southwards from the French frontier, and entering upon scenery which becomes every mile more and more dreary and desolate. On a second voyage to Spain, proceeding in the wrong direction, although familiar with the country, I found the road uninteresting enough, but this does not induce me to doubt the correctness of my first impressions recorded above.

It may be well to add one word with regard to the climate of Northern Spain and Madrid. It has often been described as affording every variety of temperature in the shortest possible time, and certainly has not been wronged. I left Bordeaux and reached Bayonne on one occasion during weather so intensely hot, that it was scarcely endurable even by those most accustomed to heat. The inhabitants wisely kept in-doors, with closed windows and shutters, and slumbered through the noonday heat as well as possible. On entering the mountains there was rain, but the heat was still scarcely endurable. After travelling some distance, and as we emerged on the table-land on the other side of Pancormo, the heat had changed to cold, which during the night was so great, that the conductor had to wrap himself up in his furs and warm cloak, and endeavour to forget it in sleep. Afterwards, in crossing the Somo-sierra, we had a thunder-storm, accompanied with hail and torrents of rain, more violent than I have often seen, and on entering Madrid I found that the heat had been and was intense and suffocating. Four-and-twenty hours, however, produced there a change so great that it was disagreeable to walk in the streets without an over-coat, although still the sun, when shining, was too powerful to be at all pleasant. These violent alternations of heat and cold are quite characteristic of high table-lands, especially when, as in Spain, they are bounded by lofty mountain-chains, rising here and there above the line of perpetual snow, and not so distant as to allow of the winds blowing from them to become warmed. In the Peninsula, indeed, the central tract consisting of high and almost unbroken table-land and the coast being mountainous, there is constantly a current of hot air rising during the summer from the bare and heated earth, and this is replaced by cold air rushing down from the mountains. The almost total absence of trees and forest vegetation exaggerates to the highest extent the evils arising from excessive temperature and rapid changes in this respect, so that now it would be difficult, without much time and labour, to replace the trees that probably at one time abounded in certain districts. Something might be done in the vicinity of the capital; but the Spaniard hates trees, and seems nowhere at home but on a trackless plain or in a treeless desert.

We are now back again in Madrid, and the reader must be

prepared to accompany me once more across the plains through Castile into La Mancha, and thence enter the grand defiles (almost impregnable if in any other country, but here neglected by the inhabitants in the time of need) which separate Andalusia from the northern provinces. The first thirty miles of this road are now rapidly traversed by means of a railway, forming part of a main line from Madrid to Alicant actually in course of construction, and likely to be finished within a reasonable time. The thirty miles at present opened conduct to the royal residence of Aranjuez, situated pleasantly in the valley of the Tagus, and more than fairly appreciated by visitors and Spaniards, owing to the contrast that exists in coming suddenly upon this little oasis after traversing the sterile wastes that extend unbroken from Madrid to the town. Like most of the principal river valleys of Spain, as I have already mentioned in speaking of the Ebro, it consists of a deep cleft in the table-land, the two sides of the fissure being often separated by a distance of many miles. In such depressions the river pursues its course, and the banks of the stream are naturally moister and more favourable for vegetation than the plains above.

After passing Aranjuez, its gardens, trees, and water-course, there still remain to traverse a full hundred miles of barren and totally uninteresting country, extending in one almost unbroken plain to the edge of the table-land. There is then seen a phænomenon of great interest to the geologist, as the road winds along not far from the foot of a low escarpment, evidently at one time the margin of a lake or sea, though now only enclosing a perfectly flat expanse of sand and limestone. The mean elevation of the table-land of La Mancha is considered to be at least 2000 feet above the sea, and the ground rises gradually towards the south, enclosing and shutting in the central provinces, and separating them most effectually from the southern. The defiles by which Andalusia is entered afford a singular and most striking contrast to the plain country hitherto traversed, and the more so as we appear to come suddenly into the very heart of a mountainous country at a very high level.

Once entered, the pass leading out of La Mancha presents a succession of magnificent views, not altogether without tree vegetation, and this character of the scenery extends as far as Bailen; the whole of the road to that town lying within the

rocky and irregular Sierra which forms the termination southwards of the great table-land, and on the whole consisting of a broken descent into the first of a series of nearly parallel valleys, reaching with alternating ridges of mountain and hill to the Mediterranean coast. It is near this point that the great deposits of lead ore occur in the mountains, and probably no known mineral field is so rich in supplies of this metal*. These deposits, associated with much silver and occasionally with copper ores, occur in each of the limestone districts parallel to the main axis of the Sierra Nevada.

Passing Jaen, the road enters a broken tract of country abounding with fruit-trees and richly cultivated, opening into the valley of one of the main branches of the Guadalquivir, the other having been crossed at Menjibar, between Bailen and Jaen. This valley opens out, and is traversed by numerous watercourses, mostly dry, between a low range of hills to the north and the chain of the Sierra Nevada, which is seen stretching out in its full extension as the road descends into the so-called *Vega*, or plain of Granada.

There is no doubt that the aspect of this plain from any of the enclosing heights is both grand and extremely pleasing, though, perhaps, it has been a little exaggerated by the natural enthusiasm of the traveller whose eye has become accustomed to utter sterility. After crossing Spain, anything green and vegetable looks delicious; but if it were not for that, I do not think the mere vegetation, as seen in passing along the road, would be considered so remarkable, while on the other hand the dust is so troublesome as to put a terrible check upon admiration of any kind. The first view of the Sierra Nevada, however, rising to the height of nearly 13,000 feet, and covered even at the end of August with very visible and numerous patches of snow, is a feature equally remarkable for its grandeur and beauty, and affords a noble back-ground to the cultivated garden-like appearance in the nearer distance. The subtropical character of the vegetation in these plains did not strike me so forcibly as

* The mines of Linares, long celebrated and exceedingly rich for lead, are situated to the east of Bailen, near the Sierra Morena. The difficulty and expense of conveying stores to the mine and the ore to market are the only drawbacks to the production, but these are sufficient to check the workings except when lead bears a high price in the market.

it would perhaps have done if I had not previously seen the east coast of Spain, where things are much more forward than they are here. For example, the figs and grapes are not ripe till September; and though at the time of my visit there were peaches, plums, apples, pears, and prickly pears (the last just coming in), the fruit and vegetables were neither fine nor abundant. This was perhaps owing to the badness of the season.

The Spanish part of Granada offers nothing particular, and does not differ from other Spanish towns, except that the houses are rather better and the streets rather wider than usual. The public places are not striking, nor do the churches seem worth looking at. The hotel where I stayed is new, excellent, and perfectly clean, with a very fair cuisine and comfortable rooms; it provides all that is wanted. There were no insects of any kind, and nothing disagreeable. It is called the Fonda de Vigaray.

The Moorish part of the town is entered by a fine Moorish gate, and is altogether oriental. It is said to be like the main street in Cairo. The principal street is narrow, very picturesque, full of shops open to the street, and in all respects unlike everything European. It is usually much crowded, and exceedingly noisy with human voices, but far too narrow for anything but a mule to pass in addition to the throng of people. The rest of the Moorish town is very poor, and much of it consists of holes cut in the rock, in which the wretched dregs of the population and tribes of gipsies find shelter.

Leaving the town, and advancing up a steep narrow street, we soon reach the gate which forms the present entrance to the precincts of the Alhambra. Under the name of Alhambra is included a considerable space of ground, formerly strongly fortified and entirely enclosed, and still defensible. It includes part of the old Moorish fortress, the old summer palace of the Moorish kings, a detestable modern carcase built on the ground formerly occupied by the winter palace of the Moors, and extensive gardens, besides numerous houses and a church. Of these, the remaining towers of the old fortress, the summer palace, and the walks and walls, are the objects of interest, the palace being that which attracts chief attention, as being probably the most exquisite existing specimen of Moorish architecture in design and execution. There is, however, no

external beauty, the walls being perfectly plain and without openings of any kind, except here and there a simple doorway. It is not till this door has closed upon one that the land of enchantment is reached, but it is then felt to be as much beyond imagination as it is difficult of description. You first enter a small cloistered court, in the middle of which is a piece of water surrounded with a small garden. Around are Moorish columns, and above a double cloister there is a passage closed with lattice-work, the retreat of the ladies when processions were passing, or other unusual events taking place in the court below, and the other a story higher, quite open. Both these and all the arches and windows are richly decorated with the most elaborate tracery. At one end of this oblong cloister is a part much more rich than the rest, opening first into an ante-room and then into a glorious hall, 150 feet high, and of the most noble and perfect proportions. It is called the Hall of the Ambassadors, and was the place of audience of the Moorish kings. With the loss only of a few of the details and some of the colouring, all here is nearly as it was left—marvellously grand and exquisitely beautiful. Out of the first court there is a passage opening into a second—the celebrated Court of Lions—communicating on one side with a small group of state rooms, the private apartments of the King and Queen, and on the opposite side with a room celebrated as the place where the Abencerages were murdered. On the third side is a singular oblong room or corridor called the Hall of Justice. I had not imagined that anything could be so beautiful as this Court of Lions *. In the centre of the court is a fountain supported by some strange-looking figures, all of marble, and supposed to be meant for the lions themselves—whence the name of the court. All that there is here is of the most delicate and rich workmanship, and resembles nothing that I had seen elsewhere. The material is marble and plaster, but the plaster is almost as hard as the marble, and is decorated with rich colour as well as delicate lace-like form. The roofs are inlaid wood-work, also very richly deco-

* This Court of Lions, reproduced with minute accuracy by Mr. Owen Jones, in the Crystal Palace at Sydenham, is perhaps one of the most attractive and beautiful objects in the remarkable group of architectural restorations there to be studied.

rated with colour. The effects of light and shade in these places at evening, and when the sun is setting, are extremely fine, and the views from them of the town and plains of Granada and the distant mountains, lovely beyond expression. I have seen nothing nearly so beautiful, and quite participate in all the enthusiasm of the warmest admirers of the place. It is indeed chiefly beauty that is to be admired, for though there are some grand things, they are all so influenced by the beauty as to cause that to preponderate in all the effects produced. There is another Moorish palace close by, in the midst of the most rich, charming, and luxuriant gardens. It is called the Generalife, and also contains much Moorish work of the finest kind. Although my time was greatly limited, I paid a second visit to the Alhambra, and spent in all not less than eight or ten hours there during the two days of my stay in Granada; but I felt that I had, after all, merely looked at, and not seen it. It requires to be studied in detail. There are many other things in the town that people are taken to see, but I could not bring myself to visit them. Indeed the cathedral and churches seemed to me in miserable taste, and did not bear comparison with the Moorish architecture.

As I do not pretend to be writing a connected and descriptive account of Spain, but merely my impressions while travelling hastily through those parts of the country that were not important in reference to the work I had in hand, I prefer leaving this description, imperfect as it is, to speak for itself, rather than write an elaborate account at second-hand to explain why this singular specimen of Moorish art impresses so strongly the imagination of persons not deeply informed in architecture, and judging merely by the eye. I confess to the general impression obtained from my visit to the Alhambra being more distinct and complete than I can remember from any other object of the like kind. I have, since writing the description, seen a good deal of Moorish architecture, both in Spain and northern Africa, but nothing has at all dimmed the impression, and I still regard the Alhambra as an architectural wonder worthy of all praise.

CHAPTER THE FIFTH.

THE VALLEY OF THE ALPUJARRAS.

The fine mountain range of the Sierra Nevada forms the southern boundary of the celebrated and rich plains (*vegas*) of Granada, and extends with occasional broad and deep valleys, and under a variety of names, towards the east as far as the coast, near Carthagena, and westwards also for a very great distance. The tract between the Sierra Nevada chain and the Mediterranean, occupying a length of sixty miles, and a breadth varying from thirty to forty miles, has been called for some centuries the "*Alpujarras,*" or pasture lands, and possesses considerable historical interest, as being the last refuge of the Moors in Europe, when, after the conquest of Granada, they were still allowed to retain a footing, and whence they were only driven, about the beginning of the seventeenth century, by the shameful violation of the treaties that had been concluded with them. They were then hunted out by Philip III. from one mountain fortress to another, being rather treated like wild beasts than as the remains of an accomplished and elegant people, to whom Europe is indebted for the germ of its noblest architecture, and for some buildings that have never been excelled for richness of decoration, ingenuity, and taste. As may be supposed, this spot offers many curious and interesting remains of its former inhabitants, and, shut out as it is from the rest of Spain, it presents also many peculiarities of natural history and geology which render it well worthy of attention and close investigation. Its most interesting points are, however, not to be reached except on horseback, and then only from two or three directions; for although a cart-road was constructed from about the centre of the district to Almeria, towards the close of the last century, and might easily be put in repair, it is at present unusable, and there is no idea of any improvement; so that the whole communication between the numerous villages of the main valley and the coast is conducted by mules,

donkeys, and horses, partly along this road and partly in the river valleys. The central part of the tract is without any regular approach whatever, as the eastern road originally extended only to some mines of lead formerly worked by the crown, and never had any communication with the transverse valley to the west, through which the only other roads necessarily pass. The isolation is thus nearly perfect, and except in reference to the mines of the Sierra de Gador, which are important and flourishing, no one thinks of penetrating this main valley between the Sierra Nevada and the parallel ranges of mountains.

But I must describe more in detail the geographical peculiarities of the district in question. The Sierra Nevada is a magnificent wall of rock, chiefly of mica schist, rising at its two highest points to upwards of 12,000 feet above the sea, and retaining for many miles the character of a lofty, continuous and impassable barrier, extremely precipitous on both sides, though most so to the south, ranging nearly east and west, and broken off or partially terminated by extremely deep and abrupt transverse valleys, one a few miles west of the city of Granada, and another east of Guadix, the intermediate distance being, as already stated, about sixty miles. Nothing in mountain scenery is grander or more majestic than this noble range, whether seen from the plains of Granada or the lofty heights of the Sierra de Gador. It is one abrupt, simple, unbroken mountain-mass, the main elevations only just distinguishable above the general level, and the whole covered at intervals with snow even in the month of August, but completely white for many months in the year. Below, on the north side, are the glorious plains of Granada, rich with olives, grapes, figs, pomegranates, maize, and oranges; and beyond them, still further north, rises another but less considerable mountain range, the commencement of the vast tertiary plateaux for which Spain is so remarkable. The picturesque city of Granada, crowned with the Alhambra and the Generalife, is seen, together with numerous villages in the upper part of the plain, near where the Darro and the Genil unite their waters and become available for irrigation on a large scale. The sources of these rivers (which ultimately unite with the Guadalquivir, between Cordova and Seville) are in the Sierra Nevada and its northern spurs, not far from the peak of Muley-Hassan,

the most elevated point in Spain*. They are, like almost all the rivers of Spain, extremely variable in the quantity of water they carry down, but, unlike a large proportion, they generally afford sufficient to be available for agricultural purposes; and to the efforts of the Moors, in the irrigation of the slopes and plains by an ingenious use of these streams, the whole riches of the plains are due.

The Sierra Nevada is so deeply intersected by the two gorges of the Guadalfeo on the west, and the Rio di Almeria on the east, that although as a mountain-chain it is really continued on either side, the name is changed and the connection lost sight of. These gorges are both occupied by tertiary sands and detritus to an extent rather astounding to geologists accustomed only to measure deposits of the same age in Northern Europe. The gorges themselves, through which now very little water passes except in torrents, and which are most part of the year perfectly dry, and form the only roads of the country, have been in many places cut through by the action of water to a depth of hundreds and even thousands of feet. So perfectly dry, however, is the atmosphere in this part of Europe, that these natural cuttings, instead of being soon filled up by the falling in of the slopes, remain permanently vertical, or nearly so, although the material is nothing but slightly coherent gravel. Roads cut through them, or in them, are in the same way left with perfectly smooth vertical or even overhanging walls on either side, often 300 or 400 feet high, a proof at once of the softness of the material and the absence of all atmospheric action.

The principal part of the Sierra Nevada and its loftiest peaks lie to the east of the city of Granada, so that the way from Granada to the Alpujarras runs at once towards the south, and is identical with a road commenced, but not finished, to the town of Motril on the coast, where a strip of almost tropical land admits of the cultivation of the sugar-cane, rice, and many other vegetable productions not elsewhere seen in Europe. After following this road for some miles, we diverge to the left, and enter the Alpujarras.

* The peak of Muley-Hassan is estimated at 12,762 feet, and there are six other peaks above 10,000 feet, all immediately adjacent, and within the range of the Sierra Nevada, in the most limited sense in which the name can be given.

Although not represented in any maps that I have seen, two distinct mountain-chains extend between the Sierra Nevada and the sea. The central part of one of them is locally called the Sierra de Gador, whose higher ridges rise to a height of not less than 7000 feet above the sea. The part towards the west is the Sierra de Lujar, and that to the east the Sierra de Alhamilla; while the parallel coast range to the south, which is not named, consists of a series of hills, probably from 2000 to 4000 feet high, and therefore little inferior to the loftiest mountain-chain in the British Islands, although far below the sierras just named. Between these various chains of mountains there are thus in the district two intervening principal valleys running east and west, besides which there are some transverse or north and south valleys, in addition to a strip of low land generally extending between the foot of the southernmost hills and the coast. The valleys between the Sierra Nevada and those sierras immediately to the south, are the longest, widest, and most important, and have been regarded as forming the whole district of the Alpujarras, by those not familiar with the ground. These valleys are two in number, being separated by a distinct watershed, and they form together a somewhat lofty plateau of tertiary detrital rock, probably 2000 feet above the sea, deeply cut through at intervals by barrancas or gorges, presenting, chiefly on the north side, or towards the lofty and snow-covered ridges of the Sierra Nevada, a perfect chaos of hills, entirely due to the eroding action of water, probably commenced at the first elevation of this tract above the sea in which it was formed, but continued since, and greatly increased, by the torrents that sweep down the precipitous ravines of the Sierra after rain, and during the rapid melting of the snows in the beginning of summer. From one end of this valley or plateau to the other, these results are repeated with every variety of circumstance and in every degree of magnitude. The total vertical thickness of the detritus cut into is very great, and it offers almost all imaginable varieties of material, from uniform heaps of fine sand to conglomerates, where angular blocks, measuring several scores of cubic yards, are mixed irregularly with rolled blocks of almost equal size, and with others of all intervening dimensions down to a small pebble. Sometimes regularly bedded and nearly horizontal, occasionally presenting singular and beautiful instances of false stratification,

and sometimes locally elevated to an angle of from 15° to 30° or even 45°, these grand detrital heaps, everywhere offering natural sections of the noblest kind, form a perfect study for the geologist, and are well worthy the attention of those who still fancy that vast and unknown convulsions must have accompanied the breaking up of whole sections of the earth's crust, in order to produce many less striking and less extensive conglomerates of ancient date in other countries. It is at least pretty certain that no such inordinate and fearful disruptions either preceded or accompanied the formation and elevation of the conglomerates in question, for the whole district appears to have undergone nothing more than slow upheaval during a long lapse of time, entirely within the latter part of the tertiary era, and chiefly at an almost recent period, accompanied only by rare and exceptional instances of earthquakes and other purely local disturbances, generally of small extent. This is indeed so much the case, that a great proportion of the thousands of square miles of detrital tertiary rock, and the still greater range of tertiary lacustrine deposits of the Peninsula, are for the most part little removed from horizontal stratification, though certainly elevated some thousands of feet above the level they occupied during the time of their original formation.

This great northern valley of the Alpujarras is, as I have said, naturally divided into two parts by a watershed connected with the central and most elevated point of the Sierra Nevada, near the grand peak of Muley-Hassan, which stands out to the north of the principal line of the Sierra, and is connected with another spur in that direction. A theoretical view of the probable nature of the movements producing this condition of things will perhaps assist the reader in fully understanding the physical geography; and I will therefore first state, in as few words as possible, the nature of the rocks and the mode in which the structure in question admits of explanation.

Without going beyond the immediate country, and connecting the South of Spain with the rest of Europe and with the North of Africa, which would be necessary before completely entering into the whole question, it is sufficient to say that the Sierra Nevada consists almost entirely of metamorphic rocks of schistose character, at one time partially or entirely overlaid by thick beds of shale, and subsequently by masses of calcareous matter of

very ancient date. These exist, it would seem, on the north as well as south flanks of the present mountain-range, and were probably originally continuous, though it is also likely that the line of elevation of the Sierra had been already determined and had actually commenced at the time of their being deposited. During the lapse of ages this calcareous matter became limestone, and at length was so far changed by time and the causes always at work amongst rocks, as to put on its present highly crystalline character. In doing so, however, the amount of contraction both laterally and vertically must have been very considerable, and as the impurities of the calcareous mud were many of them separated off into distinct beds, and the crystalline character became fully developed, these contractions passed into regular systems of fissures, chiefly vertical. During this change the whole mass of rocks of the district was being slowly thrust upwards along a line or axis ranging east and west, and the limestone, originally but little developed on the ridge, was easily and entirely split asunder and gradually carried away by the action of the currents and waves of the ocean, through which the elevation no doubt took place. A little limestone and the underlying shales remain on the immediate flanks of the Sierra, but the great mass of the deposit is not only at some distance to the south, but has a broad, deep, intermediate valley between, and presents a steep and scarped face towards the north. Even, however, at this first elevation, the upheaving force produced other results than the simple formation of the central chain of the Sierra and the subordinate flanking ranges of limestone. At various places where the limestone had been split by contraction, the resistance was overcome, these fissures widened, and the limestone thrown off on either side, thus commencing the formation of the two principal transverse valleys of the Guadalfeo and the Almeria rivers, and several subsidiary barrancas or gorges, and cañadas or depressions, without an outlet. In the former, the general direction of the inclination of the beds is east and west, thrown off in a saddle-shaped form, as would necessarily result from the cause I have assumed. In the cañadas, on the other hand, the beds incline towards each other, forming a trough. The prevailing general direction of the inclination of the limestone was, it must be remembered, originally south, as having been lifted up by the slates on a line

parallel to this rock and to the north of it. Thus a certain amount of complication exists in the inclination of the beds when first examined, which is easily explained, however, by the hypothesis I have assumed.

But the complication does not end here. At a date considerably subsequent to that at which the main elevation of the Sierra was commenced, a similar but smaller elevating force acted in a similar direction some distance to the south and near the coast, also producing its effects. These could not fail to repeat the phænomena already described, though in a less considerable degree. Thus the limestone is thrown by this later elevation to the north instead of the south, and its southern face as well as its northern is escarped, while all the principal valleys and barrancas are widened at both ends, and its cañadas or troughs completely enclosed. The limestone is thus thrown as it were into a succession of troughs or inverted saddles, presenting bluff sides both to the north and south, and precipitous walls of rock to the east and west, wherever cleft in a north and south direction. It has a rough approximation in external form to huge rectangular masses, each split in the direction of its shorter sides by barrancas, and each separated from its neighbouring mass by a wide yawning chasm, filled up often to half its depth by the fragmentary portions of similar rock and schist removed during the formation of the structure I have endeavoured thus to illustrate.

Owing to some cause which I will not here discuss, the limestone rock of the central and principal mass, and indeed of the others also, contains a considerable quantity of metalliferous ore, chiefly lead, but including also copper and silver; and the working of the mines, especially in the Sierra de Gador and its vicinity, has long been an important industrial occupation of the inhabitants. It is, however, little known at a distance, and still retains all the most remarkable peculiarities handed down from the Moors.

On leaving Granada, and passing through the deep tertiary gorges of the upper part of the Guadalfeo, I have already said that we turn to the east and enter the western side of the principal valley of the Alpujarras. The distance of this point from Granada is about fifteen miles, and we then find ourselves between the western part of the Sierra Nevada and the Sierra de Lujar,

whose elevation may be about 5000 feet, although no accurate measurements have been taken. This valley is everywhere at a very high level, the ground is much broken, the villages far asunder, the quantity of water small, and the cultivation, though not unimportant, by no means so considerable as in many other parts of the district. We are here only on the outskirts of the district, and the peculiar characteristics are hardly yet seen.

The first town in the Alpujarras is Lanjaron. There is a road, travelled by a kind of diligence, which approaches to within a couple of miles of it, and there terminates abruptly, the rest of the way being much too narrow and precipitous for anything but men and quadrupeds. In spite of this little difficulty, this spot is frequented during some of the summer months by people from Granada and elsewhere for the sake of some mineral waters it possesses. These waters taste strongly of sulphuric acid, and are cold and very clear. They seemed to me to be derived in all probability from the decomposition of a very pyritous shale which abounds in the tertiary rocks adjacent, and through which the spring rises. Sweet and pure water rises not far off in similar springs. The contact of the tertiary sands, conglomerates and marls with the old schists of the Sierra Nevada is at no great distance, and is no doubt the cause of the water being retained and given off again in this form. Springs of water are, however, rare in thirsty Spain, and are valued accordingly.

The little town of Lanjaron is pretty, and, being whitewashed, looks tolerably clean. All the houses are of the Moorish type, with their open courts in the middle, a total absence of windows to the exterior, low walls, perfectly flat roofs, and sometimes pretty minaret-looking towers. Abundance of olives, grapes, figs, pomegranates, and other fruit-trees are seen in the gardens, and as each house is in some degree detached, the whole space covered is not inconsiderable. The streets are narrow, rough, stony, and disagreeable. A Moorish castle is on a detached hill a little below the town.

From Lanjaron there is about four miles of mountain-path to Orjiba, another Moorish town of the same kind, and the capital of one of the small divisions of the district, and at this place, about thirty or thirty-five miles from Granada, I concluded a very interesting day's ride. As usual in these out-of-the-way spots, the *posada* or inn provides no food whatever, and the traveller

is dependent on what his saddle-bags may contain. You have four whitewashed walls, with two holes, one doing duty as door and the other as window, two or three very primitive chairs, the seats made of the *esparto* (the useful grass of the country, from which ropes, baskets, mats, shoes, and a number of other useful if not indispensable articles are manufactured), and an equally primitive table, which, when carefully protected by being placed against the wall, allows of plates and dishes being put upon it without much danger. To these is added, when needed, a light moveable frame like a camp-stool, on which are placed a mattress of *esparto*, two sheets, and a pillow. In the town you can buy bread, which is generally good, besides garlic, and other vegetables, such as pimento, tomato, cucumber, &c. Occasionally, but not always, you can have eggs, bad wine, oil and vinegar, and with these you may prepare your meal. The correct thing in that case is the *gazpacho*, which consists of all the vegetables you can get cut up fine, and put into a bowl with a quantity of bread and a sufficient quantity of cold water to swim the whole mess. A little vinegar and a great deal of oil are added; and the whole being well-mixed, the feast is prepared. Such a meal hardly comes up to an Englishman's idea of dinner after a twelve hours' ride, but he must take things in Spain as he can get them, and be thankful if he can get anything. Meat in these villages is almost unknown during the summer; fowls are not larger than partridges, and consist of little more than bones tied round with packthread; and sausage, which can only be had in the large towns, is harder than some kinds of wood, and after all is more deeply imbued with garlic than anything else. The wine is generally excessively bad, but the bread is white, hard, and of excellent flavour, though rather indigestible.

About daybreak next morning, my companion and I left Orjiba, and soon entered a rambla, along which kind of path the greater part of our road now lay. A rambla is so common in the southern provinces of Spain, and yet so exclusively confined to the Peninsula, that no one who has not been in that country can fully realize its nature and conditions, and yet, without some idea of its peculiarities, the style of travelling cannot be at all understood. I will endeavour to give a correct and full description of the more characteristic features of these curious phænomena in physical geography, and as I

have ridden through scores of them, and seen them in many varieties of form and structure, my description shall generalize as much as possible. The word is derived from the Arabic *Raml*, which signifies a sandy or gravelly heap.

The natural drainage of all parts of Spain, but especially of the east and south, takes place under circumstances altogether exceptional when compared with the rest of Europe. The total quantity of rain that falls annually is small in amount, and distributed over the year and over the country very unequally. It falls chiefly in the mountains, and on the Atlantic side of the Peninsula; and as the mountains are generally steep and moderately lofty, while the plains are very much above the sea-level, and in steps or terraces almost flat, there is a total absence of those hills and slopes which in other parts of Europe allow the rain that has fallen to trickle down as it were into the lower country gently and soberly. At the same time, owing to the absence of tree vegetation on the plains and high ground, no check whatever is offered to the immediate running off down the mountain-sides and river-courses of the whole quantity of rain that falls. So entirely is this the case, that, as I have already had occasion to observe, there is not a river in Spain, with the exception of the Ebro and the Guadalquivir, that has not occasionally been dry within the last few centuries. Besides the natural causes tending to dry up the rivers, there is another, not unimportant, since most of them are taken even from their sources, and the water is diverted from its channel to irrigate the neighbouring meadows. Thus, almost all the rain that falls on the whole Peninsula either runs off the surface at once, or is evaporated back again into the air.

Streams of the nature thus described being in fact little beyond mountain-torrents at one season, and hardly visible for the greater part of the year, cannot be expected to take a steady course in making their way to the sea. Guided by the smallest and least important local accident at or near their origin, they sometimes go in one direction and sometimes in another; always, however, carrying down with them enormous quantities of sand and gravel, besides blocks of stone and boulders, varying according to the circumstances of the case. In the course of time, the rain falling over a district thus cuts out for itself, and partly fills up, numerous channels, any one of which would be far more

than sufficient, if there were an average steady current, but which are all barely enough to carry off its waters when swollen by any unusual circumstance. The sand, gravel, boulders, and other material brought down, are found in many cases to form a wide irregular channel, or dry bed, through some part of which the stream, if any, always flows; and when, as is often the case, the direction is strictly limited by lofty and almost vertical walls of rock, the whole intervening space at the bottom of such a gorge (or *barranca*) is occupied by alluvial matter, and affords the only passage from one part of the country to another, not only for the water, but the inhabitants. A river-channel of this kind, either permanently dry from the entire removal of the water to another direction or its entire re-evaporation; or occasionally dry, and generally capable of being traversed as a road, is a true Spanish Rambla:—the fashionable walk in some large cities, as Barcelona, where the ground has been raised, and the stream permanently directed into another course; the true and constant river-course over many plains; the actual and only road in many mountain tracts; and the sandy or gravelly path almost always, fully answering to the Arabic origin of the term. When dry, no road is better marked, and none more easily traversed on horseback; when rain has fallen, none can be more treacherous, dangerous, and uncertain. A few hours of heavy rain on the mountains will bring down a torrent that carries away trees, houses, and bridges, if they stand in the way; while a few hours of dry weather reverse the scene, and a few weeks clothe the once desert tract with rich vegetation. Many of the Ramblas, indeed, are more permanent, and trees of many years' growth attest the comparative tranquillity that has reigned; but all partake of the same general character. There is no phænomenon of nature in northern European climates that in any way resembles this: and were a change to take place by which these channels became permanently covered with any depth of water, a large proportion of the towns of the south of Spain would be as effectually cut off from all ordinary means of intercommunication as if they were placed on a group of detached islands.

Along such paths, formed naturally by alluvial sand and gravel, and liable at a few hours' notice to be swept away, and altogether remodelled in many essential points, the communication from Orjiba towards Berja is entirely carried on. The river

bed of sand and alluvial gravel cut in the tertiary deposits, rises gradually towards the east, till it attains a considerable elevation near the peak of Muley-Hassan before referred to; it then terminates abruptly, and the steep mountain-sides rise all around; but a path has been cut over these mountains, barely sufficient for the meeting of two mules even in the wider portions, and we thus pass from one Rambla to another in a different water-shed, which has to be traversed in a similar manner. There is something singularly strange and new in first seeing and following these dry water-courses. With every mark of violent water-action, scarcely a drop of water is to be seen; and, at most, there are a few little pools and a sluggish stream, often barely visible, and almost always contemptible. We go on and on, over miles of such natural road, solitary, barren, and waste, often shut in by naked rock many hundred feet high and steeply escarped, but everywhere reminding us that a day of reckoning must be looked for, and that the great blocks of limestone and schist under our feet are not permanent deposits. They are, in fact, mere play-things, dashed about, and carried down to the sea at a very short notice, as soon as the rains once more descend, and the mighty torrents coming down from the steep Sierra unite and plough out a fresh channel through the heaps accumulated in some former progress. The road, if so it can be called, proceeds onwards through these paths in a wilderness of valleys, until at length it reaches the important transverse valley of the Adra. From this it soon diverges, crossing another ridge of some elevation, commanding a fine view of the Sierra de Gador, and descends at length into another part of the same valley near the rich and prosperous town of Berja, the centre of the mining district of the Sierra de Gador.

Berja is not situated in the valley between the Sierra Nevada and the limestone sierras immediately to the south, but between these latter and the coast range, or rather in the opening near them, and between the Sierra de Gador and that of Lujar. It has been greatly enriched by the successful mining operations in the Sierra de Gador, and contains some modern and neatly built houses. The whole place, indeed, is modern; as the older town was almost destroyed by an earthquake in the early part of this century; and thus it possesses but few Moorish characteristics, beyond the general style of the buildings, clearly adapted from

the ancient inhabitants. The habits of the people, too, are Asiatic, although the taste of the Moors is certainly not shown in the church and town-hall, the public buildings that adorn the market-place.

From Berja the fine range of the Sierra Nevada is well seen through the opening between the Sierras de Gador and Lujar, and the town is almost enclosed by high ground. Being tolerably well supplied with water, the vegetation as well as the scenery is very interesting. From one window of my apartment, I looked across a garden with orange, lemon, pomegranate, fig, and palm trees, to the distant white patches of the snowy range; from the other window I could see the Sierra de Gador with its countless mines, indicating a large but concealed population; while my rest both by day and night was disturbed by the incessant clatter of the hoofs of mules and donkeys bringing down the ore to convey it to the coast, or returning lightly laden with the few necessaries required by the miners, who, however, receive all their food, wine, &c., and even their water, conveyed in this way for a distance of many miles.

A path, if so it can be called, in the ever-changing Rambla, affords for the greater part of the way the only means of communication with the sea-coast at Adra, where the ores of lead are smelted, and whence they are exported chiefly to Marseilles and the United States. Here the climate approaches that of the tropics, and admits of the successful cultivation of the sugar-cane, as well as rice, in the lower plains where irrigation is possible. Indeed the ordinary canes of this part of Spain are sufficiently remarkable for their luxurious growth, and in some places they reach not less than twenty or thirty feet in height, forming a kind of forest on either side of the gravelly bottom of the valley. The sugar-cane is not so lofty. I also noticed some very finely-grown plantains, but was informed that the fruit of these more distinctly tropical productions rarely ripens to perfection. The cactus (prickly pear) is luxuriant beyond everything, and at the time of my visit (late in August) the hedges were covered with millions of its grotesque but not very pleasant fruit. The aloe also flowers freely, and numerous stalks, twenty or thirty feet high, stand staring in the landscape, like so many decayed telegraph poles, while the dingy and decayed-looking flower, when present, hardly added to the beauty.

Adra itself is rather a lively and pleasing town in the autumn, when a good many people come from the interior to enjoy the sea-bathing. The accommodation could hardly be more primitive. A very small hut (one only) like an Indian wigwam, very scantily covered with reeds and dead grasses, serves as the dressing-room, but is at some little distance from the water. When ready for the bath, the lady who has prepared herself here, (the gentlemen despise such little luxuries,) makes the best of her way to the sea, and there enjoys the satisfaction of bathing, whilst watching the various promenaders on the shore passing within a few yards of her. When she wishes to retire, a nymph, who seems to act the part of laundress and fishfag as well as bathing-woman, comes down with a large cloth and a kind of dressing-gown, and receives the lady on coming out of the water, throwing the cloth round both together. In the kind of extempore tent made thus by the attendant and the cloth, the lady arranges herself in the dressing-gown as well as she can, and then quietly walks up the two or three hundred yards to the hut, where she dresses as quickly as possible, to make room for another.

Although an old town, founded by the Phœnicians, and provided with a picturesque tower, said to be Roman, and the remains of a fine Moorish castle, Adra owes all its importance to the smelting-houses for lead, which have directed hither a large part of the lead ore not only from the sierras immediately adjacent, but from various places along the coast, as far as Carthagena. A considerable shipping business is thus produced, as the smelting requires fuel, which is obtained from England chiefly, and the lead, when produced, has to be exported. The principal smelting-house includes a manufactory of sheet-lead, lead pipes, shot, red lead, white lead, and even pigments, and was established originally by the late consul, Mr. Kirkpatrick, but it is now chiefly in Spanish hands. The lead is desilverized by Pattinson's process, and the machinery and arrangements were evidently very complete when first established.

The country that intervenes between Berja and the coast consists chiefly of slaty and schistose rock, in which, as far as I could learn, no fossils had been found. The geological age, indeed, of all the older rocks in this part of the Peninsula must be considered as still very doubtful; and the main facts to be

observed and remembered are rather those of structure than age. No minerals of value have yet been found in this southern range, which is probably a repetition of the rock of the Sierra Nevada, brought up at a later date, and elevating the overlying shales and limestones with a somewhat northerly inclination.

From Adra through Berja is the regular and, indeed, almost the only road at present used to reach the mining district of the Sierra de Gador, and I followed this route on more than one occasion, first merely to the mountain summit, and afterwards across the summit into the Eastern Alpujarras. The whole mass of the upper part of the Gador range consists of hard, semi-crystalline, and highly metamorphosed limestone, abounding with crevices and irregularities. It is generally of dark colour, but greatly veined with white and more crystalline portions, and occurs in beds of various degrees of hardness, occasionally containing large quantities of remarkably pure sulphuret of lead (galena), mixed with a loose calcareous sand, in bunches or floors. The depth of the mines hitherto worked is not very great (rarely if ever reaching 100 fathoms), but the surface over which small shafts have been sunk is extremely large.

The rise to the upper part, or mining district, from the rather high valley of Berja, is extremely steep, one side of a narrow gorge being cut into a long tortuous path, which it takes a horse or mule at least three hours to ascend. The views both of the near and more distant scenery, in rising towards the upper part of the Sierra, are extremely fine, and extend across the whole of the lower intervening metamorphic ridge, into the valleys beyond, and far across to the deep blue waters of the Mediterranean. The mountains themselves, and even the barrancas, are cold, gloomy, barren, and desolate. After a weary progress of a couple of hours, vast heaps of loose alluvial sand and gravel mark the first approach to the mining ground, and afford a curious proof of the abundance of the ore, since these are produced by the labours of poor miners, who earn a scanty livelihood by digging and sifting the alluvial gravels for fragments of lead ore buried amongst them. This operation resembles that elsewhere called "streaming," and followed commonly enough in the case of gold and tin ores, where water is at hand; but it is singular enough to find it adopted here, where not a drop of water is available even for drinking that is

not carried several miles on a mule's back up the long and steep ascent. It is evident that a large quantity of ore must have been some time or other removed from the parent rock, to admit of this system being in any sense economical; but it is said to yield a very certain though only a small profit, and is permitted by the government to be carried on without any preliminary claim being set up, or any legal and formal grant being made.

Continuing along the mule-track, we soon come in view of one of the most remarkable parts of this district, where the ground is literally turned inside out by thousands of human moles, who have burrowed, generally with pretty fair success, but have unfortunately left behind them no other indication of the nature of their work than the earth-heap at the top of the deserted shaft. The colour of this heap, however, especially where the work is still going on, marks at once whether the operations are succeeding or have failed. The ore is found associated with a white sandy substance, and this has only to be separated by sifting. Where the heap, therefore, is white and dusty, ore is being obtained; where blue or brown, the result is hitherto unsatisfactory. Clouds of the white dust are blown by every breath of air about the top and sides of the Sierra, and afford ample proof to the instructed eye of the general success attending the subterraneous work.

The top of the Sierra de Gador is not a ridge, but a plateau, occasionally broken or hollowed out, and showing on the whole the main characteristics of a lofty plain. Although rain occasionally falls, the water soon runs off, and the surface remains as it is usually seen, dry, parched, barren, and desolate. Not a tree, scarcely a blade of grass is to be found; and a few miserable *ventas*, and the houses, or rather huts of the smallest size (*cortijos*), placed near the shafts, at once for shelter and protection, are the only things that break the dreary monotony of the dusty hillocks already referred to. Although tolerably familiar with mining ground, I know no district which possesses so exclusively its own characteristic aspect as this Sierra in the South of Spain.

Down a partial depression in the limestone surface, and past other mines only in operation within a short time, I proceeded to descend the northern face of the Sierra, and enter the principal valley of the Alpujarras on this the eastern side. During

one of my visits the whole mountain was enveloped in cloud, which became rain indeed only at its lower extremity, but which effectually concealed everything at a distance of more than a few yards. On another occasion I saw enough of the magnificent mountain range and intervening valley to enable me to judge of the effect. The descent on the north side is exceedingly steep, and the scenery grand in the extreme, affording a mixture of the weathered and broken schists, the fractured but jagged limestone, and the deeply-worn soft tertiary sands and clay, these materials affording great variety and great beauty both of form and colour. Continuing to descend, we come at last into the valley, where several Moorish villages and towns are passed one after another, making an admirable foreground and middle distance to the landscape. These lie at the foot, or nearly so, of the great snowy range, but far below the limit that the snows approach even in winter, and being for the most part removed some distance from the only path along the valley, they are hardly ever entered by strangers. The land around is beautifully wooded, and some of the finest and oldest olive-trees I have ever seen grow in the district. All this ground is high but sheltered, and the vegetation partakes of the usual character of that seen in the valleys of the south of Spain away from the coast. Maize grows abundantly. The orange and lemon exist, but are not very common; the fig, the pomegranate and the pear are the principal fruits, and the olive and vine afford the oil and wine so necessary in this country. Melons are, as usual in Spain, infinitely abundant, and for the most part of large size and fine quality.

I stopt at night at the village El Fondon, near some lead mines of the same name, and enriched by the vicinity of these mines. From this place there are several miles of road well planned, and once well executed, leading towards Almeria. The road, however, laid out by the government at a time when all mines were the property of the crown, has been entirely neglected for nearly half a century, and is in many places so entirely out of repair, that it is hardly passable for the very roughest kind of wheel-carriage. It conducts to the rambla of the Rio di Almeria, and passes a number of very grand mountain gorges in the limestone on the Sierra de Gador side, coasting that range for the whole distance, and laying bare its

geological structure at various points. The centre of the valley is occupied with tertiary deposits and alluvial detritus to a vast thickness, and deeply intersected by other and smaller gorges; whilst on the opposite side, where the limestone is absent, the shales and schists rise out of the tertiary accumulations, and form the slopes of the loftier Sierra in that direction.

Entering at length the rambla of the Almeria river, we pass other and more populous villages, and discover indications of a much warmer climate than in the upper valleys. Here the palms and plantains may be counted by hundreds instead of tens, the canes are luxurious, the fruit-trees loaded with fruit, and everything announces the approach to those subtropical strips so remarkably characteristic of the south coast of Spain. The soil is rich and entirely tertiary; the mines, though they do not disappear, become less important, but still a few smelting-houses, at rather distant intervals, are to be seen on the hills. On the opposite or east side of the rambla rises the Sierra de Alhamilla, a continuation of that of Gador, terminated towards the coast by erupted porphyries and serpentines, where nickel, and subsequently silver and copper, have replaced the lead. In the Alhamilla itself indeed, lead appears as in the Sierra de Gador, but the mines have not been much worked, nor are the results hitherto very favourable. Between the two Sierras in this wide gorge is a singularly extensive development of the tertiary sands and conglomerates, and some semi-detached hills form a partial ridge, almost appearing to rival the limestone range itself in elevation, but belonging evidently to a very modern period.

In this part of the country, and not more than ten miles from the coast, there is abundant proof of recent local elevation on a considerable scale, sometimes, no doubt, preserving the horizontality of the deposits, but sometimes communicating local disturbances of dip to the extent of 15° to 20°. All this district has been long subject to earthquake action, and many of the small towns and villages have suffered more or less by various shocks within the last century. Of late, however, and for several years, the ground has been much more quiet, and the people having observed this, attribute it to the opening of the mines. However this may be, it is certain that there are few

spots in Europe where the earth has been more perseveringly burrowed into.

From the rambla we at length emerge into a road commenced but only partly finished, like most things in Spain, and intended to communicate from Almeria to Granada. It was once traversed by a kind of diligence, but this has ceased, as the speculation was unsuccessful. The road is tolerable for some distance, and the entrance to Almeria is pretty. The town is first seen on reaching the summit of the last of a series of tertiary hills of considerable elevation, and presents an outline of singular beauty, owing to the extensive remains of an old Moorish castle and fortifications. Within the walls the town is lively and cheerful, the streets pretty good, and the houses small. Being the chief town of a province, it is of some importance, and a considerable amount of trade is done with various Mediterranean ports; but the accommodation at the best inn, or rather boarding-house, prettily situated, by the way, in a small *alameda* or public walk, is wretched beyond description. Bare whitewashed walls, two or three rickety chairs, a much more rickety table of minimum dimensions, a washhandstand that might go into the smallest cabin of an emigrant-ship, and two trussel-beds, formed the accommodation. Walls, table, floor, and washhandstand were so filthily dirty, that one might easily have scraped off a considerable quantity of useful enough material for manure, and the beds were far more adapted for the satisfaction of fleas than the repose of bipeds. Such, alas! is Spain too frequently. Nature has done all in her power, and has showered every luxury of climate and fertility on these shores. The inhabitants, however, are utterly indifferent to everything; they allow these rich gifts to take their own course; the fruits may ripen or rot as they will, and cleanliness, comfort, and even the commonest decencies of existence are totally disregarded.

Beyond the valley of the Almeria river, the district of the Alpujarras terminates, and the character of the scenery, as well as the structure of the country, appears to change. The whole tract is singularly interesting, both for its present condition, its physical and geological peculiarities, and its past history. Here, in the history of nature, have been formed some of the grandest modifications of limestone rock and shale to be seen in Europe;

near here has been elevated one of the loftiest mountain-chains of Europe; here have been accumulated some of the largest deposits of pure galena known to exist in the world; here have been executed, perhaps, more surface and shallow mining works than are elsewhere to be found on an equal space of ground; here have dwelt and mined the old Phœnicians and Carthaginians, the Romans, and the Moors, first in their glory, then in their decline; and still more recently have been brought here the mixed race of Castilian conquerors, who endeavoured to annihilate their hated enemies by the most perfidious infraction of all agreements made with them, and drove them at last to seek refuge and revenge in acts of piracy, which long harassed the commerce of the various ports of the Mediterranean. Within this district may be found the products of Africa, Asia, and tropical America, flourishing side by side with those of temperate Europe. We find here all climates, from that of perpetual frost to an unvaried spring or burning summer; torrents of rain, and spots where rain hardly ever falls; streams abounding with trout and other fishes, and dry river-courses where there is hardly moisture enough to support the cactus or the fig. We have here some of the finest and grandest mountain-scenery in Europe, some of the wildest and most savage desolation, some of the most charming secluded valleys richly clothed with wood, and some of the most picturesque villages and houses embosomed in gardens, and surrounded with honeysuckle and other charming flowers. There is here a strip of coast fringed by the blue waters of the Mediterranean; and one may indeed say, in the words of an Arabian poet, that, so far as nature has willed, it is "a land where, if thou walkest, the stones are pearls, the dust gold, and the gardens paradise."

ISLAND OF SARDINIA.

I. THE COAST, THE COUNTRY, THE TOWNS, AND THE PEOPLE.

II. THE MINES AND MINERAL RESOURCES.

THE ISLAND OF SARDINIA.

CHAPTER THE FIRST.

THE COAST, THE COUNTRY, THE TOWNS, AND THE PEOPLE.

Fig. 9.—*Group of ancient Roman Vases from the Western Coast.*

Of the countless herds of English and other travellers who are always to be met with in almost all the better known and much-talked-of cities of Italy, scarcely more than half-a-dozen in a year, and often not so many, cross the channel that separates the States of the Church and the Kingdom of the Two Sicilies from the large and important islands of Sardinia and Corsica. These form an almost continuous ridge of very high land, extending for nearly 400 miles in a direction due south of Genoa, from whence Cape Corso, the most northerly point of

Corsica, is about 100 miles distant. Of the two islands, Corsica, which is much the smaller, is almost connected with the main land of Tuscany, by the string of islands, Gorgona, Capraia, Elba, Pianosa, and Monte Christo, the channel between these and the Corsican shores being about eighteen or twenty miles wide. Corsica, again, is only separated from Sardinia by the Straits of Bonifacio, about four or five miles wide; and thus all these islands together may be regarded as links of a chain, mountainous throughout, and generally very lofty, branching from the Apennines where the latter first leave the Maritime Alps, and exceeding in importance, in a geographical sense, that more celebrated but hardly more interesting range.

On the voyage from Genoa to the Island of Sardinia, the land is kept in sight, while sailing along the Italian coast, past the Gulf of Spezzia, as far as Leghorn. At this point the small islands of Capraia, Monte Christo, Gorgona, and others are in sight together, and conduct the eye to the Island of Elba on the one side, and the mountains of the northern promontory of Corsica on the other. Of these, Elba and Capraia have every appearance of being identical in composition; and while touching at the latter island, a number of geological specimens were brought on board, most of them so strictly identical with the well-known iron ores of Elba, that one was almost induced to speculate whether the fisherman had not brought over the specimens from this locality. I believe, however, they are from veins which seem to crop out very prominently on the north side of the island, and are perhaps continuous with the great iron lode of Elba. Before passing Capraia, the mountains of Corsica come into view, and the shores of the island, even from the northernmost extremity, are exceedingly bold and often grand, consisting of a succession of capes, between which are bays of greater or less extent. The coast is well seen on approaching Sardinia, as the only regular means of communication is by steamers leaving Genoa every five days, and running alternately to Cagliari, the capital of the island, situated in the extreme south, and Porto Torres, near Sassari, a large town at the northern extremity. My business requiring my presence in the south of the island, I took advantage of the steamer to Cagliari, leaving Genoa the 10th May. This voyage generally occupies about forty-two hours, but the

weather being unfavourable, my passage was upwards of fifty, and the vessel did not reach its destination till about two o'clock on the morning of the third day from Genoa. Although the sea was rough, with that short disagreeable swell common to narrow and confined oceans, the weather during great part of the voyage was tolerably clear, and I greatly enjoyed the sight of the coast as we steamed along from Cape Comino across the Gulf of Orosei to Cape Monte Santo, and thence close along the shores of Ogliostro, celebrated for the excellence of its fruit and wines, into the Gulf of Tortoli.

The steamer stops a short time at Tortoli to take up passengers for Cagliari, and exchange mails. The bay is calm, well sheltered, and picturesque in its form. The two extremities or horns stretch far out into the sea, and are continued by islands. Two small towers, one on the shore and another on the headland called Cape Bellavista, not only remind the traveller that the works of man are at hand, but in their construction and condition they speak of the centuries that have passed since the island was first inhabited, and the vast changes that have passed over the human race, without effacing the former works of his hand.

The interior of the bay of Tortoli is flat towards the central part, but the country rises behind towards the fine mountain range, of which Gennargentu, one of the loftiest peaks in the island, is the crowning point. This height is nearly 6000 feet above the sea, and is a true mountain in every sense.

Near Tortoli, and for some distance along the coast, the cliffs are high, and rise very steeply from the sea. The town of Tortoli is situated behind these cliffs, and is not seen from the sea, the eye ranging over a wide extent of coast, and recognizing hills at some distance in the interior without detecting any marks of the small villages and towns which were originally placed out of sight to escape the notice of the dangerous foes who at one time navigated these seas, levying fearful contributions if at any time they descended on the coast.

The mountains approaching the sea at Cape Bellavista, and there projecting to form the headland bearing that name, consist of hard rock, the bedding being nearly vertical, alternating with softer rock easily washed away. The coast between the projecting points is generally pierced with holes, often of large

size, into which the water enters; and over a considerable extent of coast there is evidently deep water immediately off shore, as the fragments that fall from time to time are immediately removed by the action of the waves, and the steep escarped faces of the hard rock go down directly into the water.

Passing from Cape Bellavista, the next point seen is Cape Sferro Cavallo, also a fine headland, having a ferruginous look from the sea, and probably containing much iron ore. Near this point is Tertania, where numerous metalliferous veins have been discovered, containing copper ore, and where some mines are in work, though not at present making much profit. The metalliferous district of the island may be said to commence near Tortoli, on the coast; it extends thence a little to the north-west, but chiefly to the south, reaching in that direction quite down to the southern shore. Another metalliferous district, rich in lead, occupies a somewhat similar position, and is similarly limited, on the opposite or western coast of the island.

After Cape Sferro Cavallo the next principal point is Cape Ferrato, which juts out nearly three miles into the sea, and terminates so abruptly that within half a mile of its extremity there is from sixty to eighty fathoms of water. The true mountain character of the coast is well seen, not only here, but almost everywhere, by the great depth of the water immediately adjacent to the projecting headlands, and occasionally also by the extreme irregularity of the soundings. As a general rule, it will be found that the rocks in this part of the island are nearly vertical, and strike east and west, consisting of some very hard and some much softer portions. The latter being necessarily more rapidly acted on by the mechanical action of the waves and by atmospheric influences, are worn away much more than the former, which are left as headlands or cliffs as the case may be.

After passing Cape Ferrato, night set in, and I saw no more till the next morning when I landed, at about five o'clock, at the little port of Cagliari, beautifully situated, and sheltered from almost all winds by the peculiar arrangement of the hills adjacent. I was soon established in the Albergo del' Universo, but did not at that time stay long in the town. Within a few hours I was again moving on, being however this time provided with a horse, and crossing the country instead of coasting it.

My business in Sardinia had reference to certain mining concessions for working veins of lead and copper, of which there are a vast number in the island, including many whose importance is well known and has been long recognized. In the course of my wanderings with this object, I had occasion to visit a great deal of extremely wild and uncultivated country amongst the mountains both east and west of Cagliari, and was obliged to cross the plains in various directions, and visit, for the sake of a meal or a night's lodging, a number of small towns and villages, in most of which strangers are so rare, that no accommodation is provided except by the hospitality of some inhabitant. I may say, once for all, and as the only acknowledgment in my power, that I have nowhere been more cheerfully, more hospitably, and more kindly received, than in these remote and rarely visited spots. Everything that could be obtained was always provided at once, and as a matter of course. No questions were asked as to what one would like, but as soon as possible after arrival, the soup, meat, bread, wine, oranges, and such other things as the house or village could provide, were put on the table, and I and my companions were expected to partake of them, the providers scarcely even looking for thanks; and in some cases giving up their beds, and lying on the floor, that we at least might be as comfortable as possible, whatever became of themselves.

Without carrying the reader along with me in my zigzag movements, chiefly in the lead district to the west, I will commence with a general sketch of the physical geography and geology of the southern part of the island, and some account of the capital, and the inhabitants; and then give a more detailed notice of the mountains and rocks, chiefly of course with reference to their structure and contents, but not neglecting their peculiar features of vegetation, and their picturesque character.

The island of Sardinia is about a hundred and sixty miles in length, with a mean breadth of about seventy miles. Its form is extremely compact, the only exception to the rectangular shape being a large promontory towards the south, situated to the west of the Gulf of Cagliari, a smaller promontory near Sassari, in the north-west, and a straggling tract of high land stretching northwards into the Straits of Bonifacio to meet the southern

extremity of Corsica. There are two rather considerable islands connected with the former of the two promontories, and one which is a continuation into the sea of the northern extremity of the latter. The whole of the east coast without exception is mountainous, and indeed almost all parts of the west, north, and south shores, so that from the sea no one could imagine that plains extended through the country, almost unbroken by considerable hills, and capable of the richest cultivation. Such plains, however, do exist; and the most remarkable of them, commencing at Cagliari, stretches towards the north-west to the Gulf of Oristano, a distance of about fifty miles, with a breadth of from ten to fifteen miles. There is a still further extension of this plain in a more broken condition, making in all between seven and eight hundred square miles (nearly half a million of acres), every part of which without exception is capable of the highest cultivation, and could produce, with very little trouble, all those forms of vegetation which are consistent with a warm climate and a somewhat considerable rain-fall. The climate is greatly modified by the form of the island and its generally mountainous character, by the north-west and east winds, which blow strongly and very frequently, and also by a great variety of circumstances which constantly interfere to modify the condition of the air in a confined sea. In addition to these points, there must also be taken into account the existence of large tracts generally covered with water, and offering an enormous surface for evaporation. The mean annual temperature at Cagliari, taken for three years, by M. della Marmora, is stated at about 62° Fahr.; the mean temperature of the hottest month (August) rarely if ever rising to 90° Fahr., while the mean of the coldest (February) is sometimes as low as 34°.

In spite of this range, we find the palm (*Chamærops humilis* and *Phœnix dactylifera*) flourishing in sheltered places, the cactus (*Opuntia vulgaris*, Haw.) forming the ordinary hedge of the country (although introduced from South America), and numerous beautiful orchids covering the ground in moist sheltered places, and even on the hill sides; while the orange and lemon, the fig, the pomegranate, and the vine, yield fruit of quality rarely equalled, and perhaps nowhere excelled in Europe. Grain of various kinds could be produced to almost any required

extent; excellent wine could be exported; and, in addition to the fruits already mentioned, all those of the temperate climates of the continent of Europe could certainly be cultivated to great advantage. It is painful to have to observe, however, that these valuable resources of national wealth are almost entirely neglected. A small population, scantily distributed in villages, only cultivate sufficient land for their own use. Commerce is neglected, and the only means by which improvement could be ensured, and so rich a country be made available, are altogether lost sight of by the Government. In the whole island there is but one high road complete, conducting from Cagliari to Sassari, and one other road in course of construction from Cagliari to Iglesias. Of the latter about ten miles are completed. It was remarked to me by a priest at whose house I stayed one night, that for sixty-four years the people had been paying a tax for roads which were not yet even commenced; and in another place I heard of a bridge, for making use of which a heavy toll has been charged ever since its construction, but which has never been repaired, and is now in a dangerous state. The greater part of the country, even only a few miles distant from the two roads mentioned, is totally unapproachable except on foot, or by horses which have been trained to travel over paths such as are rarely seen in the worst mountain-passes of Alpine countries when in their worst condition. It may be that in many of these places roads could hardly be expected, but certainly there might be, and ought to be, such paths from village to village in the plains as could be readily travelled by carts and even loaded wagons. The Sardinian Government has not thought this necessary; and thus, instead of being a granary to supply large districts with corn and fruit, this island, placed midway between Spain and Italy, in the high road of the Mediterranean, with excellent ports and every natural advantage, is hardly visited by any vessels except those driven in by stress of weather, and could not supply any important demand for those articles which it is best adapted to produce.

There is, however, one drawback, which, in the present state of the country, is undoubtedly very serious. For three or four months in the year, the rich plains I have described are subject to a very fatal and widely-spread malaria. During the spring months a good deal of rain falls, and the extensive ponds and

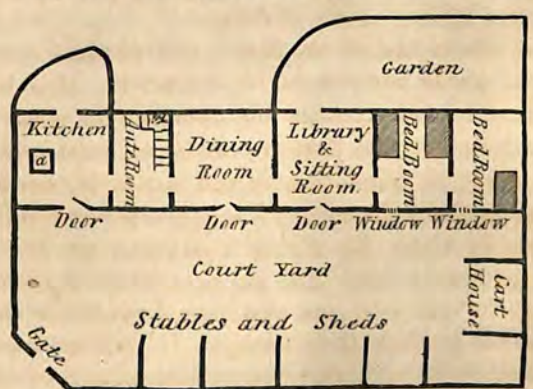
shallow lakes throughout the plains are covered with water, which doubtless also receives a very large quantity of animal and vegetable matter. The great heats of summer produce a rapid evaporation of the water, and also a decomposition of the organic matter, and the air immediately above the water thus becomes loaded with noxious gases, the result of putrefaction, which are probably amongst the most fertile causes of all malaria fevers. Whenever, in this state, the night-air is a little cooler than usual, and the sky is covered, mists and fogs rapidly form and spread over all the low ground, being also occasionally carried far up the valleys; and these naturally enough produce fever, if an unfortunate traveller or inhabitant is exposed to their influence. The dreaded malaria of Sardinia is, indeed, but too real an evil; and during the short time I was in the island, I heard of so many recent and fatal cases arising from the most casual and slight exposure, that it was clearly a very serious source of danger.

Cagliari, the capital of the island, is a pleasant town, partly Italian and partly Spanish in its character. It is built on a steep hill, and is thus rather objectionable in some respects. Immediately outside are Roman remains of considerable interest, including an amphitheatre and a temple, besides many houses cut in the solid rock. The views across the bay, especially those in which the distant mountains are brought into sight, are extremely fine. The public gardens are well placed, and though not extensive, are charming, both in the shade they afford and the position they occupy. In them are seen palms, aloes, several varieties of cactuses, besides numerous other trees with which I was less familiar. The cactuses are very beautiful, and one creeping kind covers many of the walls, and flowers brilliantly.

The other towns of the south of Sardinia are for the most part small, consisting of little more than irregular villages. The intervening country, with the exception of the tract of level land already described, is almost without exception mountainous; the hills being high, separated from each other by narrow valleys, and very numerous and continuous. The cross roads are in some places blind tracks running along the water-courses of the streams, or across heath, mountain, and forest; and occasionally, on the other hand, consist of paths worn into

hollows a foot or two in depth by the feet of mules and horses. The smaller villages are quite Moorish in their appearance, the houses being large and low, enclosing a court-yard, and having no openings towards the street. Indeed, many of the rooms have no windows of any kind, the only light admitted being by the door, which opens into a verandah running round two or three sides of the interior of the court. The houses are usually of one story, and cover a good deal of ground; but the streets are gloomy, and without the smallest feature of interest. Within the court-yard are collected the various farming implements not in use; and the stables, sheds, &c. form one or two sides of the court. The subjoined ground-plan of the house, outhouses, &c. and garden, of a hospitable priest in the town of Gonnos, in the interior, will convey an idea of this style of construction.

Fig. 10.—*Plan of a house at Gonnos Fanadiga.*



On entering even the better sort of houses, one generally meets with the roughest accommodation; and although one or two rooms are perhaps set aside for state purposes, the different members of the family assemble in the kitchen, whence they rarely remove except to bed. In one instance, in the house of the syndic or mayor of a village of some importance, about one-half the kitchen was occupied by a donkey grinding corn for the use of the household. The mill was perfectly simple, and probably of exactly the same kind as that which has been used for centuries. It consisted of a large stone, of hard conglomerate, placed on the ground, and another to which the donkey was

harnessed, and which he turned round. It was, in fact, the quern on a large scale.

In houses of this kind, belonging, it may be, to farmers, it would hardly be expected that there should be large presses filled with the most interesting and valuable dresses. This is, however, the case. The national costumes of the Island of Sardinia are as curious as they are varied, and include some rarely surpassed for richness and costliness, and even remarkable for a certain amount of good taste. At the village of Quartu, near Cagliari, I was taken to visit a family who were kind enough to exhibit their costumes, and was shown some whose value, in rich

Fig. 11.—*Group of Sardinian Villagers in their National Costume.*

gold embroidery, bracelets, chains, brooches, and material, were considered to be worth at the present time not less than from £120 to £150 sterling. Such costumes descend from parent to child, and not being worn more than five or six times a-year, do not often require repair or re-arrangement. The costumes are by no means alike even in the same village, and differ extremely in different parts of the island.

I had the opportunity at one small country village of seeing a dance and some other amusements of the peasantry, but the costumes were not worn in this case. The men were the chief dancers, and one after another performed some curious *pas seul*, executing it elaborately in the most monotonous manner and with the greatest gravity, commencing their exhibitions, however, only from the time when I was seen approaching, attracted by the somewhat novel scene. Before my arrival, several men had been dancing together in a ring with a few women, much in the style of our morris-dancers, but to the music of a small antique pipe of two or three detached reeds. Except when both are in full costume, the men are better and more picturesquely dressed than the women, and on this occasion there was no comparison, as the latter were dirty and in very ordinary every-day clothes. The costumes of the men in the towns are extremely bright and varied, being made of purple and scarlet cloth, and covered with silver buttons. The scarlet dye of the cloth is of the richest tint, and is obtained from the island.

In the central and northern part of the great plains of Cagliari are numerous villages, generally close to the mountains, and many others concealed within the valleys opening out towards the interior. Some of these are large and thickly peopled, but for the most part they, as well as the others in more retired positions, scarcely occupy half the space they have formerly done, and indicate a marked falling off in the population of the island. There is little doubt that the malaria is, and always has been, a great source of evil, but it can hardly have been so bad in former times, when the plains were cultivated, as it is now, when no efforts are made to drain the surface and improve the land. Where proper means are used, no land in Europe is better capable of producing corn, wine, and oil, besides numerous fruits and vegetables, and substances for dyeing, tanning, and other purposes. Cork and ornamental woods are also obtainable to any extent, and beneath the surface are large supplies of valuable minerals, yielding lead, silver, and copper to an extent rarely paralleled. In another chapter I will endeavour to communicate some results of my experience in these matters, obtained in the southern part of the island, where the mining operations have been chiefly carried on.

I must not conclude this chapter without a few remarks on the antiquities for which the island of Sardinia is famous. These are of various kinds, and date back from the earliest period of which we have any records.

Conical monoliths, such as that represented in the annexed cut, are met with frequently, although rarely in so good a state of preservation as the centre one of the group, which is unfortunately now destroyed. It was nearly 20 feet high, and bore

Fig. 12.—*Ancient monoliths in the island of Sardinia.*

slight marks of the chisel, and is described by Monsieur della Marmora (Voyage en Sardaigne, vol. ii. p. 3) as just thrown down at the time of his first visit in 1830. This and many other monuments of the same kind probably belong to some of the earliest forms of idolatry practised in any part of the world. Other remains, of the nature of cromlechs, are only less ancient, and appear to be sufficiently abundant and perfect to justify careful observation.

There is, however, a class of rough but distinctly-built towers distributed all over Sardinia, which, under the name of *Nurhags*, have long attracted the attention of archæologists, and

which are much more striking to the eye of the general traveller than most of the antiquities of a date previous to civilization. These are built of roughly-hewn stones, put together without mortar, but in regular courses, and, when complete, presenting the form of a truncated cone, with a circular or elliptic base. They are generally carefully constructed, and have one, two, or three rooms in the interior, in floors one above another, the lower one having small niches. They are entered by a hole so low, that a man has to creep in on hands and knees.

Fig. 13.—*A Nur-hag or ancient round-tower in Sardinia.*

So numerous are these singular constructions, and so widely extended, that upwards of 1270 have been actually counted in ninety-six of the 376 communes of the island, and as there is no reason to suppose them to be more rare in the remaining 280, this would give a total of nearly 5000 for the whole island. Their origin is of the most remote antiquity, being described by Roman authors as of ancient date, and attributed by them to the Greeks. It appears more probable, however, that they were constructed by yet earlier inhabitants, and that the idea of their construction was derived from the East. They were most likely of that mixed utility that would admit of some being used as watch-towers and fortresses, and others as religious edifices, or for funereal monuments.

Besides these architectural remains, numerous idols, as well Chaldean and Phœnician as of western origin, abound in certain districts. Carthaginian antiquities are also sufficiently common. The annexed cut represents a side view, and a sketch of the intaglio, of a small *scarabæus* of green jasper in my possession.

Fig. 14.

The Romans, at an early period, took possession of the island of Sardinia, and obtained from it large supplies of corn, and also of lead and silver. It may well be imagined that they left behind them proofs of their long possession. Roman remains of all kinds abound, and are often extremely interesting. Among them are some very fine specimens of glass and pottery. I obtained a number of objects of this kind when in the island, and a group showing a few of them is subjoined*. I also received subsequently, through the kindness of Monsieur Calvi (a gentleman whose acquaintance I made at Cagliari, and whose mines near Arbus I had visited), a remarkable and most interesting leaden sarcophagus of late Roman construction, but without any inscription.

Fig. 15.—*Group of Roman vases from Sardinia.*

* See also the group at the commencement of this chapter, p. 167.

CHAPTER THE SECOND.

MINES AND MINERAL RESOURCES.

THE island of Sardinia supplied the Romans, and before them, the Carthaginians and Phœnicians, with a very large quantity of lead and silver, and probably also with much copper, and appears to have once possessed extremely rich lodes of the more common ores of all these metals very near the surface. The mineral ground extends over all parts of the mountain-country, and appears to be extremely rich, but the actual work done in mining for many centuries has been so small as to be almost inappreciable.

The Campidano, as already observed, separates the mountains on the east side of Sardinia, which are chiefly granitic and contain copper and iron, from those of the western side, which more commonly contain lead. This remark applies at least to the southern part of the island, which alone I visited; and although mines do extend into the northern portion, I am not aware of their condition or value. Granite and porphyry are found in the interior, and form the great central mass or nucleus of the elevated track, and around it are grouped schists and limestones, chiefly belonging to geological periods of somewhat ancient date.

Of the porphyries and granites, the latter are chiefly in the northern provinces, but very beautiful examples are seen in the mountain "dei setti Fratelli," near Capo Ferrato, on the east coast, and within sight of Burcei. These mountains are extremely bold and picturesque, and the granite is of fine quality. Further north, towards Ogliastra, are the mountains of Gennargentu, composed of schistose rocks, wrapping round a central crystalline mass; and here copper ores have been discovered, said to be of much promise. Many of these schists in various parts of the island contain veins of anthracite, showing that they are probably metamorphic limestones, perhaps of no very ancient date. Towards Burcei the rock is metalliferous, but not to any great extent; at least the mines shown me were not pro-

mising, and contained mere indications of galena. The approaches to the mines on this side are fearful, it being necessary in many places to dismount and lead one's horse down precipices and along the steep naked mountain faces. There is here a good deal of schist, but such veins as I saw are poor, and hardly justify very extensive researches.

By far the larger part of the mineral-field that came under my observation consisted of calcareous rocks, often highly crystallized, and passing into true marbles, sometimes of beautiful quality. These generally repose on schists and alternate with them, and the mineral veins, which are extremely numerous, appear, as is usual in similar cases, to make ore near the junction of the two rocks.

Near Flumini-maggiore there is a black marble of the carboniferous period, containing, it is said, orthoceratites and encrinital remains, but I saw no specimens of fossils. Near Iglesias the limestones are perhaps of the same date, and on the coast, at no great distance, beds of coal have been discovered, though it does not yet appear whether they are worthy of much attention. Other limestones, belonging to the secondary period, are less perfectly crystalline, and one of these, in the island of Antiochus, is said to resemble the hippurite limestone.

Magnesian limestones, and some that are oolitic, form extensive deposits elsewhere; and through the Campidano—the plains already mentioned—there is a wide range of country occupied chiefly with tertiary limestones of no great antiquity.

Basalts and other volcanic products of various but inconsiderable age are also met with in some parts of the island. I have given this general sketch of the rocks most widely and abundantly distributed, that the geological reader may be aware of the foundation on which my views of the mineral wealth are founded.

By far the most abundant ore found in the limestone district is galena, which is usually argentiferous, and often very rich in silver. Some of the mines are amazingly rich, and have a wide reputation, but generally they are so badly worked as to be failures, in spite of large quantities of good ore near the surface.

From Iglesias, the mining centre of all this part of the country, the road from Cagliari is intended to proceed southwards by the mine of Monte Poni to the sea at the Gulf of

Palmas. The mine thus named is one of a very few that have been somewhat extensively worked in modern times, and it is valuable as giving an idea of the way in which the lead deposits occur. The rocks are here schistose and highly metamorphosed limestones, alternating with each other. The strike of the rocks is north and south, and the dip east, where seen near Iglesias, but both appear variable. The shales are weathered, but not rotten, where exposed in the valley. The entrance to the mine is high up in the steep face of a mountain, and the openings of several levels are seen one above another. The ore is in groups of pipe veins parallel to each other, close to the contact of schist and limestone, and, generally speaking, the veins are rich where the pipes extend parallel to the strike, but the underlie does not correspond with the dip of the strata, being generally much more considerable. Hitherto there has not been found any limit to the richness of the pipes in depth, but the breadth of the metalliferous portion is variable, and often inconsiderable. At the mine in question, some of the veins bore ore for 40 or 50 yards. The thickness of the lode varies, but at the time of my visit, and generally, it averages from 3 to 5 feet. When a pipe of this kind is reached, it yields a good deal of ore, and on being exhausted at any given level, it seems usual to cross cut to find another, rather than go down to a greater depth*. The mountain on which the mine is worked is not less than 3000 feet high, and has an extremely steep face towards Iglesias. The ore is considered to extend to the hills on the other side of the valley.

Proceeding from Monte Poni towards the coast, the way lies over trackless mountains and through valleys richly clothed with cork-trees, and affording the most enchanting glimpses of the sea. We at length reach Monte Nebbida, a high limestone mountain about half a mile from a small bay formed by the action of the sea on the softer schists coming out on the shore. Several lodes are visible in this neighbourhood.

I may remark that here, and indeed everywhere in the district north of Iglesias, nearly as far as Arbus, the mines occur in vertical or highly-inclined calcareous metamorphic rocks alternating with schists, and the mineral veins bearing ore are

* Something of the same kind has been observed with reference to the limitation of the workable portions of the veins in Derbyshire.

usually near the contact of the limestone and schistose rocks. The strike of both beds and lodes is generally north and south, but there are not wanting strongly-marked and important cross courses. The limestone near the lodes is often dolomitic, and indications of galena (almost always argentiferous) are seen wherever costeaning pits have been opened, or where the face of the lode has from any cause been laid bare.

The Monte Nebbida mines (so-called) consist of bare indications of lodes, with the exception of an old Roman excavation of some extent, plainly showing that valuable mineral has once existed here. The access to this at present is by a singular ravine, too rough to allow even the little country horses to travel along it, and demands a long and steep ascent between and amongst huge blocks of limestone fallen down from the rugged escarpment on either side. The excavation is called St. Peter's Grotto (Grotto di San Pietro), and seems to indicate the former existence of a group of veins probably parallel and near together, having a total width of from 10 to 15 fathoms, the whole of which required to be removed to obtain the ore. The veins run north and south, and the limestone near is dolomitized. If more accessible, this point would be very promising, and would justify sinking to some little depth, commencing on the opposite side of the mountain, in a valley near Iglesias. Under existing circumstances, however, hardly any result would be sufficiently important to justify the necessary outlay.'

Another interesting lode, or group of lodes, traceable to some distance, may be conveniently called *Genna caru,* that being the name of one of several mining claims here made. At a point some few miles north of Iglesias, one very prominent and important north and south vein, dipping west, has been opened in various places about nine miles from the sea, this distance requiring, however, four hours to travel. Other nearly parallel veins or feeders, and various strings, appear to belong to the same group. At the crop the lode looks extremely well for argentiferous galena, and as the ground is covered with old lead scoriæ, and numerous pieces of litharge, sometimes of large size, have been picked up, it is pretty clear that a Roman establishment of some importance was placed here. It is also likely that the silver formed an important part of the produce. Large surface works are manifest on the lode at several points. The most important

points are near the junction of limestone and schist, where the limestone is dolomitized. A fine gossan is seen at the crop.

Several claims have been made, and permissions of research granted, on the run of this lode. Of these, *Sartu arenas*, on the opposite side of the valley from that above referred to, is the most definite, as there is a convenient point for an adit to cut the lode at considerable depth, and to this point the old workings do not seem to have extended.

At some distance towards the north, in a magnificent gorge extremely difficult of access, is another mine called *Gutturu vallu*, which I have little doubt is on a continuation of the Genna caru lode. There are here four inches of solid galena visible in a costeaning at the crop. No old workings seem to have reached this point, but the extreme difficulty of conveying the ore to a port would greatly interfere with profitable working.

Towards Arbus the limestones and shales are interrupted by granite, which, at no great distance, rises to an elevation of nearly 4000 feet. The direction of the lodes is changed near this contact, and they are more frequently traversed by cross courses and contras.

Perda de s'Obiu is a powerful and well-marked lode, whose direction is north-west and south-east magnetic. It is seen as a ridge crossing two or three mountains, and has been opened near Flumini-maggiore, a little to the north-west. It is of good promise, and is worth continuing. It has been partly, but insufficiently, proved at two or three points, one of them in a valley conducting without interruption to the valley of the Flumini-maggiore, below the town. The works at present consist only of a short level on the lode, which appears not to have obtained its true condition near the surface. If ore should be found on further prosecution of this gallery, it would be very easily and cheaply worked, and there is a back of at least 100 fathoms.

Between Flumini-maggiore and Arbus is exposed a powerful east and west lode, generally metalliferous, and of a very promising character, projecting above the ground as a rough wall, and crossing at right angles a ravine not far from Arbus. This lode is in schists near granite, and dips south about 70°. It is called *S'acquu bona*, and has been opened by a small adit, badly placed, considerably above the level of the valley. It shows five

or six inches of solid galena at the surface, and several tons of ore were got in making the small level alluded to. The galena is of fine quality, and the lode very promising. There would here be a mine of some value if the lode be found to improve on continuing the level, as the extent of back is very considerable, and the cost of mining would be extremely small. A large quartz lode appears to cross this at some distance, but the junction has not yet been opened upon.

The whole of the limestone district in which are the mines and lodes hitherto described, partakes of the same general character, and the various mineral veins evidently belong to one system. In addition to the peculiarities already noticed (of which the pipe-like character is one of the most important, and the uniformity of strike, but difference of underlie, when compared with the stratification of the rock, another of almost equal interest), it may be well to state that the lodes are without well-defined walls, and contain ore irregularly distributed. It often happens that galena is seen disseminated in fine grains through the dolomitized veins, strings, and threads, near the contact of the different rocks, and in this respect there is perhaps more analogy in condition between this district and some of those in Central France and the Aveyron, than there is in the case of the masses of lead ore occurring in flats in the south of Spain, or courses of ore found in some other districts. In all parts of the district veins occur, so that there is no difficulty in making claims based on some apparent discovery; but it will be probably found that the whole of the great mass of the rock is in fact metalliferous at intervals, wherever crevices occur partly or entirely occupied by limestone, and modified by magnesian vapours. Blende in small quantities is associated with the galena, and occasionally also copper and iron pyrites, but all these are exceptions to the usual condition. Silver is more common, and even, on the whole, more abundant, but it is rarely to be obtained except from the lead.

As is not unusual in limestone mines, there is very little water in the deep sinkings, and none that need at all interfere with work. The usual mode of conducting mining operations in the country is, however, very primitive, and the engineers greatly need some scientific suggestions, as they are neglecting in most cases that systematic opening out of the lodes in cases

of success, without which, in any district, mining is a needlessly speculative business.

In the first operations also, they are apt to fritter away considerable sums in partially opening, in the most inaccessible places, a large number of strings and lodes, or the same lode at several points, whereas the money would be much better spent in effectually proving a few promising indications somewhat nearer such means of communication as would justify continuous working.

The limestones and shales containing the mineral veins already alluded to, and many others which I was unable to visit, are succeeded, towards the north, in the neighbourhood of Arbus, by a narrow belt of granite, also containing rich metalliferous lodes; after which, further towards the east, basalt and trachytes come in, altering greatly the aspect of the country, and occupying the eastern part of a range of high ground in this vicinity. These rocks rise to the height of 5000 feet, or thereabouts, in the Punta di Arcuenta, or Thumb of Oristano, where the trachyte is crowned by a huge grotesque mass of columnar basalt. Near this spot the granite also rises to a considerable elevation, reaching at Monte Linas to 7500 feet above the sea, being flanked by basaltic rocks and lavas. The granite varies a good deal both in colour, texture, and durability; but in this vicinity it was pale, even-grained, composed of small crystals, and readily decomposing. The country roads are sometimes worn down twenty or thirty feet in this rock by the mere action of the rough wheels of the country wagons that have for many centuries rolled over it.

In the granite beyond Arbus is a mining district (also for galena) not without considerable interest. The rock itself, as I have just stated, readily decomposes; but it is intersected by strong quartz veins, almost forming dykes, which being much harder than the enclosing country, project in strong ribs, and may be traced without difficulty along the surface. Near the surface they are generally discoloured by iron, and show a well-defined gossan.

Near Aubus, to the north, is a very powerful north and south lode, crossing the granite and rising prominently into a ridge, extending for several miles. There are also some other almost equally remarkable ridges, more or less nearly parallel, but

manifestly occasionally intersecting. A small level has been driven at a point near where one of these intersecting lodes or feeders enters the main north and south lode alluded to, and as the lode was first cut on the side of a small ravine opposite the intersection with the main lode, it has been followed in the wrong direction. From this feeder, however, a good deal of extremely rich argentiferous galena is said to have been taken, and a portion of the lode is still in sight above the level. The branch thus opened runs north-east from the main lode, and is apparently itself one fork of a branch of considerable importance. This point is well worth working out.

The main north and south lode near Aubus, on the south side of the hills, running east and west, and known as Monte Vecchio, is not less than twenty feet in width, and often much more, rising often twenty or thirty feet above the present level of the granite, which has been decomposed around it. It is composed of tough ferruginous and argillaceous rock, with quartz, and is much honeycombed; the interspace being either empty or filled with ferruginous mineral, and about four to five feet wide.

The appearance of this lode traversing the country in a straight line, and utterly bare of vegetation, except where partially covered by a few yellow and red mosses, is very striking. It appears to range for about seven miles, being probably terminated to the north by the basaltic rocks of Point Arcuentu, and southwards by the limestones or shales east of Fluminimaggiore. Not far to the west the schists re-appear.

Crossing the mountains in a slanting direction, we come on the other side in sight of the dressing-floor and buildings of the mine of Monte Vecchio, which is opened at four points by short cross cuts leading to the east and west lode, distinctly traceable at its cross along the surface. The mine is worked in a hill nearly 1000 feet above the lowest level. As I saw this mine only by the permission of the Director, and under peculiar circumstances, I do not consider myself at liberty to give any description of its appearance and prospects.

About seven or eight miles west of Arbus, and close to the sea, is a very promising mine, partly opened by old workings and partly by recent excavations, called *Fossu Scuau*. There is here a principal north and south lode, with a cross course and

two feeders almost parallel to each other, and coming in from the west. There has certainly been a good deal of ore got in former times from this spot, and there seems to be a group of valuable veins, but the recent operations have been conducted without the smallest knowledge of the first principles of mining, and the lode has been most pertinaciously avoided in one level, which was indeed properly commenced, but in which the direction is needlessly altered, probably within a few yards of cutting the lode. The ore obtained from this lode is extremely rich in silver.

In concluding these few remarks on mining in Sardinia, I desire to place on record my firm conviction, that, although, from various causes, the actual mining properties visited by me were, with few exceptions, undesirable as investments for foreign capitalists, there is not only a great opening for further research, but an almost certain profit to be obtained, provided a fair amount of care is taken in commencing and carrying on operations. Sardinia has, in former times, been greatly valued as a mining country, and its reputation in this respect might readily be regained, by operations carried on with any degree of skill, in various quarters. It has unfortunately happened, that few persons having a knowledge in mining or engineering are to be found in the country, so that the proper means have really not been taken for proving the real value of the lodes discovered, or the extent to which they have been exhausted by the ancients. It has also been forgotten, that, in the present state of the roads, very few even of the richest mines have a high marketable value, in consequence of the total impossibility, within a short period of time, of carrying their development to such a point as to justify a large expenditure either in labour or machinery; while most places near the plains are too unhealthy to allow of men being placed there for more than eight months of the year.

In considering the value of a mineral district, the cost of wood, and the abundance or scarcity of water, are questions of great importance. The wood commonly used in Sardinia for mining purposes, appears to be the evergreen oak, which is generally cheap, plentiful, and durable. The exact price I could not accurately ascertain, owing to the smallness of the demand in the districts I visited; but it is certainly not an expensive article. The water is variable, and rarely more than

sufficient for washing and dressing ores. There is but one really important stream in the island, and few of the others, though occasionally they may convey large quantities of water, could be depended on for motive power.

The sea-coast on the western and eastern, as well as southern side of the island, presents several ports at which minerals could be embarked, and some of them are conveniently placed. The Gulf of Cagliari, the Gulf of Palmas, the Gulf of Oristano, and the Gulf of Tortoli, all afford good ports; and there are many smaller intermediate harbours, that would be very convenient for shipment.

Coal and lignite exist in the island of Sardinia, the latter of fair quality and the former anthracitic. Both have been well spoken of, and have a good appearance; but the reports of the engineers who have tried them for steam purposes are not favourable. The lignites are in nearly horizontal beds, and are widely extended. One group, varying in thickness from a few inches to three feet, is worked near the small village of Gonnessa, near Iglesias, where a miliolite limestone overlies unconformably the fossiliferous schists of the Silurian period, in the immediate vicinity of a hill of trachytic tuff. It is considered that these beds might have some economic value, but they do not promise much at present.

Limestone in all its forms, including some highly ornamental marbles, can be obtained plentifully, as will be gathered from the account of its distribution already given. Clays of various kinds are also found, so that there is every facility for building, as far as materials are concerned.

The ordinary constructions of the country are sufficiently solid, and the Roman remains (usually built of hard limestone) are in good condition; the climate also is favourable for the preservation of such objects, as rain is not abundant, and frost extremely rare.

AFRICA.

I. THE TOWNS AND PEOPLE IN THE PROVINCE OF ALGIERS.

II. THE PHYSICAL GEOGRAPHY AND MINERAL RESOURCES OF THE PROVINCE.

CHAPTER THE FIRST.

THE TOWNS AND PEOPLE IN THE PROVINCE OF ALGIERS.

Fig. 15.—*Costume of the Arabs of Algeria.*
bis.

THE first visit to a new country is, under any circumstances, a matter of considerable interest even to the hackneyed traveller; and when the new country is in a continent hitherto unvisited, and introduces one to the most complete change of habit, race, costume, and scene, the interest is naturally a good deal heightened. My first approach to the African coast was then a matter to which I looked forward with a good deal of interest.

I left Marseilles in a little screw steamer, about three o'clock in the afternoon, on the 18th September, 1853, and after a very stormy passage of sixty-three hours, arrived within sight of the chain of the lesser Atlas mountains, and the small coast range on which the city of Algiers is built, just before sunrise on the

morning of the 21st. The scene was striking. The distant mountains are very distinctly marked, and present a bold, rugged outline, serving as a background. The hills rising immediately from the shore were partly covered with vegetation and partly occupied by the town, of which the houses rise one above another in irregular order almost to the top, which is occupied by a fine ancient Moorish fortress and palace, called the Kasbah. Everything constructed is, without exception, either covered with whitewash or built of white marble; and the odd mixture of small square houses with flat roofs, small chapels with domes, larger mosques with domes and minarets, and some public buildings of recent date, gave a character to the scene altogether different from anything I had seen. The town is quite compact, and nearly triangular; the point of the triangle being the top of the hill 500 yards above the sea. It is included within walls, but there are numerous small suburbs at some distance, all of the same character; and these, with a few isolated houses and religious buildings, add to the picturesque effect.

Jutting out into the sea a considerable distance is a T-shaped jetty, forming an artificial but apparently well-sheltered port, within which I saw numerous steamers and other vessels. Boats, with the singular sails so usual in the Mediterranean, were sailing about, lazily enough; and several small boats came out to meet us, manned with Arabs. We landed, and made our way into the town, whose first aspect and modern streets are so essentially French as not to attract much attention. In this way I reached my hotel without any particular adventure.

I soon, however, sallied out on a voyage of discovery, and was at once struck with the people and costumes. In the principal market-place, near the Place Royale, were groups of Arabs, Moors, native Africans of the northern tribes of the interior; others from greater distances, and many Negroes, mingled with French, Italians, Spaniards (chiefly from the Balearic islands), &c., all in their peculiar costumes. The chief objects for sale consisted of fruit, and included figs, peaches, pomegranates, bananas, prickly pears, pears, apples, grapes, and innumerable melons, all in great profusion and extremely cheap. The vegetables were not so varied. Men were the chief salesmen; but women of all kinds and costumes were

seen about. The most striking, certainly, were the native Moorish women and Jewesses; the former enveloped entirely with white of greater or less fineness, according to the rank and fortune of the wearer. The dress is singular. They wear trowsers quite full and tied in at the ankle, a singular and indescribable dress round the waist, and a kind of very thin white blanket, entirely concealing the form, and reaching to the mid-leg. The whole face and head, except the eyes, are covered with the same thin white material. Although I had often read of this, and seen figures of the women, the reality was extremely striking; and I could not help staring at every woman I met, for some time. They are, however, abundant enough; though I saw few that did not give me the idea of being old. In those less richly clothed, the feet were often visible, but in the others they were entirely covered.

Next to the Moorish women, the Negresses were most curious; as they prefer gay colours, and their faces, and even arms and legs, are left quite uncovered. They wear head-dresses of turban shape, and striped scarfs, sometimes of very pretty material. The variety of race was very considerable, and many of them were really good-looking. Like the Moors, they wear large loose trowsers, but these terminate at the knee, and their dress is altogether far more open than that of the white races. The Arab women, it is said, do not appear; and, except in the case of Moorish females, it is rather difficult at first to distinguish the men from the women. Many of the men, however, are very lightly clothed, and afford magnificent specimens of the various races to which they belong. Some are complete Turks, with their stern, gloomy aspect, and long beards and moustaches; others, Arabs or Jews, equally well bearded, but quite distinct; others again are closely clipped, like the French boys in Marseilles. Many offer interesting varieties of the Negro, or jet-black tribes, and some are as sinister and disagreeable-looking as most of them are quite placid and interesting.

One of the first objects of interest at Algiers, where the domination of the French has enforced toleration, is a visit to the interior of a mosque. I went into one in the principal street, the only ceremony required being that the shoes should be taken off; as, however, the whole interior was either carpeted or matted, this was no great sacrifice on a warm day.

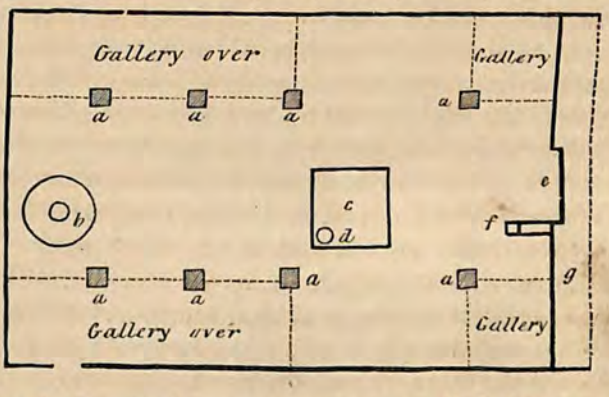
The mosque I first entered was a fine building, but of no great elevation. It measured, within the walls, about 180 feet by 150; and consisted of five principal aisles on two sides of the building, two aisles on a third, and one on the fourth; but towards this end (the south) is a small interior court, with a fountain placed towards its southern corner. At both the east and west end were small rooms apparently adapted for religious purposes; that at the east containing a copy of the Koran, while those at the west were bare, like the interior of the building. With the exception of matting, and some carpets, the whole was completely unfurnished; but there were a few niches and recesses rather more decorated than other parts. A number of persons were lying down in the building, and several were employed in drawing water and carrying it to the western end of the mosque; but I saw no appearance of worship of any kind, nor was there anything impressive or striking in the style of fittings or decoration. The aisles were formed by moresque arches of the usual form, many of them out of proportion, and all rather irregular. The windows were very low, and looked upon a small external gallery; and the doors consisted of openings in the wall, without other means of closing than a mat suspended before them.

The chief of the old Mosques of Algiers is now a temple devoted to another kind of idolatry. It is the Roman Catholic cathedral. Although little altered, the presence of a high altar, some wretched pictures, and other marks of adaptation, have rather injured the effect of this simple and elegant structure. Like the one just described, it is an oblong building of beautiful proportions, but it has only one row of columns, and with no open court. It is also much smaller. It is lighted by windows in the upper part, constructed of open stonework of extreme elegance; and the arches are equally effective and simple. The outside of this mosque presents two minarets of no great elevation placed at the chief entrance; and the adjoining building, now used as the residence of the Governor of the Colony, is a most exquisite specimen of Moorish architecture, though not at all in the style of the Alhambra.

A third mosque that I visited (see cut, fig. 16) differed considerably from the other two, and was provided with a dome and fine minaret, besides having several curious galleries, and

some singular platforms and small pulpits, both fixed and moveable. A plan of the building is given below. The most

Fig. 16.—*Ground plan of a Mosque at Algiers.*



curious of the miscellaneous constructions alluded to, consisted of a detached platform of wood (*c*, *d*), about fourteen feet square, immediately (but not centrally) under the dome, and an extremely elegant but very small pulpit (*f*) of white and inlaid marbles, near a highly decorated niche (*e*). The columns (*a*) are so placed, that, with the small galleries between them and the walls, the interior is divided into an open nave and transepts. There is a small entrance near the fountain (*b*), and a narrow exit (*g*) to a gallery or terrace outside the building.

Each of the mosques has a marble fountain, with pure running water. The devotees, on entering their place of worship, sometimes, but not always, wash their hands and feet. They then frequently lie down, and appear to go to sleep. From time to time one sees them get up and place themselves in a particular position. Then again sitting down, with the face towards Mecca, they begin to tell their beads, bowing from time to time till the forehead touches the ground, and gesticulating with their hands and arms. No females are admitted within the walls; though I once saw some lively French women, with their shoes off, peering round the corner of the entrance.

Among the peculiarly Eastern objects that are met with in Algiers, I must not forget the camels. The first time I saw them was in a string of twenty-three, with two or three horses, conveying a number of Bedouin Arabs. They looked miserable

enough, and did not give me much idea of the comfort of riding on their backs.

It is totally impossible for anybody who has visited only European cities, to form an idea of the streets of Algiers. They are generally so narrow, that two persons can hardly pass without touching; so tortuous, that you can hardly see a dozen yards ahead; so steep, that going up or down them is more hilly or stair-like than passing from the lower to the upper town at Edinburgh by the narrowest and steepest of the old wynds, more slippery, dirty, and badly paved than even those singular ways of communication; and, in addition to all this, the upper parts of the houses on one side of the way generally project forward, so as almost to touch the opposite houses. The only openings to the streets consist of open doorways. A small interior court, open above, generally serves to give light to all the rooms; and the doors, even of the best houses, are often in the worst parts of the worst streets. Thus, the house of the British Consul — an extremely pretty specimen of Moorish architecture, constructed as an official residence by the last Turkish Government — is in a part of the town difficult to get at in any way, and totally unapproachable except on foot. This peculiarity is, however, so common as to be characteristic; and, after all, the Moorish style, both of houses and streets, is better adapted for the climate of Algiers, and its susceptibility to earthquake action, than the lofty but insecure houses of Marseilles fashion that the French are running up towards the skies.

The temperature of Algiers is high in the summer months, ranging about 90° to 94° in the shade. Further in the interior, it is of course hotter. But, although the plantain and date-palm grow freely, they hardly ripen their fruits sufficiently to pay for that sort of irregular cultivation they have hitherto had. All the fruits of southern Europe flourish, however, well; and, near the coast, there is great luxuriance of growth. The meat is tolerably good, and much better than in any part of Spain. The style of living being French, it need not excite surprise that the *cuisine* should be more than endurable.

At the time of my visit, Algiers was unusually gay, in consequence of a fair being held. There were, however, no native products, except those offered for sale by the regular trades-

people of the town, who had stalls in the fair; and the chief objects of attraction were children's toys, gingerbread, imitation jewellery, &c. The attraction was great for the native women, who wandered about in great numbers. This fair, coming after those of Beaucaire and Marseilles, offered nothing very enticing to the European traveller, though the colonists seemed to appreciate it fully.

Before leaving the town, I made a point of visiting the *Pepinière*, or nursery, established some years ago under the superintendence of Mr. Hardy. It is a most charming and interesting locality, and cannot fail to be of the greatest benefit to the colony. It is situated about three miles from the town, towards the south, and close to the sea, being well sheltered by the high ground rising on three sides, but having perfect ventilation.

In this garden we find large groves of plantains, the fruit of which is sold by public auction. There are also extensive groves of orange, lemon, &c., numerous palms of different species, all fruiting and ripening their fruit in the open air, the *Ficus elastica* growing to a great height, the Dracæna, Yuccas, and numerous other South American, Indian, and other trees which we are accustomed to see only in hot-houses. Thus their appearance for the first time in the open air makes one fancy the climate far more tropical than it really is. I noticed numerous species or varieties of the common cactus (*Opuntia*), so abundant in the south of Spain, and many other remarkable forms of plants not uncommon in the warmer portions of Europe. The important part of these gardens consists, however, strictly in the nursery, as hence are obtained the cotton-trees and many of the mulberries, of which thousands are conveyed to favourable positions every year; here has been grown, so as to ripen perfectly, the tea-plant, and here also are performed many important experiments calculated to throw a light upon various points on which the interests of the colony may depend. The general arrangement and condition of the garden are in the highest degree satisfactory.

In addition to the botanical portion of the garden, a few ostriches and some other birds are kept in two enclosures; and it would add much to the interest and popularity of the establishment, if a collection were made and kept here of the

more rare of the indigenous wild animals, both quadrupeds and birds. Perhaps a reptile-house would be even more useful to the naturalist in determining important points in the economy of such of these animals as are indigenous in Northern Africa.

The other towns of the province are much less important than Algiers, and for the most part are too entirely modern and French to require any special notice. There are, however, a few exceptions, and I will begin with a few words in description of Cherchell, which well deserves such precedence, not indeed from its present importance, but from ancient recollections.

At Cherchell* is all that remains of the city *Julia Cæsarea*, long the principal seat of the Roman empire in this part of Africa, and now presenting a mass of ruins, scarcely indeed recognizable in many places, but sufficiently extensive to prove the former importance of the position, and of a nature which shows that no expense was spared in the decoration of the houses and temples. The present town occupies but a small part of the space enclosed even by its modern walls, but the *enceinte* of the Roman city is still traceable far beyond the present enclosure. The city was well placed, occupying a slope of moderate extent and elevation, rising at once from the sea, where there is a small but secure port, well protected by a natural mole, and defended by a castle at its extremity. Behind the town the ground rises rapidly to hills of considerable elevation, and about ten miles to the south is the range of Djebel Beni Amram, whose highest point is nearly 5000 feet above the sea. From this part of the coast there is a communication by the valley of the Hachem both to the town of Milianah in the valley of the Cheliff, and also to the plain of the Metidja at Marengo, so that the two principal rich tracts of low land of Algeria are at once and conveniently reached, the former within a day's journey, and the latter in four hours. Within the town there is not much to be seen of its ancient grandeur beyond innumerable columns and fragments of columns of granite, porphyry, and extremely hard brecciated marble, literally strewed about in every direction, and employed for the most ignoble purposes. I counted no less than fifty of these columns of very

* In the nomenclature of the towns and other places in Algeria, I have thought it best to adhere strictly and in all cases to the mode of spelling adopted in the maps published by the French Government.

large size, many of them nearly perfect, lying in the open space between the gate at the eastern end of the town and the houses. There is hardly a street or a lane in which fragments are not to be seen, either used as posts, lying on the ground unused by the sides of the houses, serving as low fences or walls to the gardens, employed as rollers for the road, or heaped up with other fragments of stone too cumbersome to be moved. Nearly a hundred columns of considerable beauty, and of the hardest porphyry, are built into a mosque now used as a hospital, and the smaller ones more easily removed serve every purpose that their form will admit. It is difficult to conceive whence have been derived so large a number of objects, not easily prepared at any time, and certainly only used in costly buildings, whether public or private. Their precise object it is equally difficult to guess at.

Outside the walls, on the eastern side of the town, are other proofs of the extent and magnificence of this ancient city. The ground is extremely irregular, owing to the vast heaps of bricks, stones, and rubbish derived from the falling down of the old buildings. Some massive vaults of brick and stone have withstood the attacks of time and the destroyer, but they are shapeless masses, overgrown with fig-trees, cactuses, brambles, and weeds of all kinds. All that can be seen is the existence everywhere of fragments of former grandeur, and one can better understand the descriptions given of the present state of buried cities in Assyria, Mexico, and elsewhere, after examining the mountains of rubbish that here elevate themselves on all sides, and watching the effect of the plough as it turns up at every inch some fragment of brick, plaster, or pottery, instead of those pebbles and fragments of rock that under ordinary circumstances are seen. The whole subsoil, to a depth of many yards, entirely consists of debris of human labour; and the hills, of which there are a great number, are nothing more than ruins of larger dimensions, belonging to loftier, more solid, and more important constructions.

The actual Roman remains at Cherchell in a sufficient state of preservation to be recognized and described are exceedingly few, and not very important. A part of the castle, a portion of an amphitheatre, and a part of the ancient walls, are all that can be shown; but numerous inscriptions, and some fine works

of art in marble, have been dug up, the best of which are now in the museum at Algiers.

Not far from Cherchell, and crossing a small valley opening out to the sea, are remains of a large brick aqueduct, probably intended to convey water to the ancient city. The distance is about three and a half miles. I was not able to trace its further extension, but from its noble proportions and great elevation, it must have belonged to a work of magnitude.

About the same distance beyond this ruin, and on the road to Milianah and the plains, another fine aqueduct, also of brick, and in better preservation, crosses a small valley opening out of the valley of the Hachem to the left. This valley communicates by a path to the city, passing through the village of Bacáara. It is likely that this also served to supply the population of the ancient city with water.

To the west of the present town the Roman remains are not less evident, though apparently the buildings were not on so large a scale. Here also the fields are covered with fragments of former houses; the foundation walls serve for the divisions of fields, and the ground is elevated considerably by the ruins. The edifices appear to have been to a great extent constructed of brick, those of stone being chiefly ornamental; and the floors were evidently of that common mosaic-work well known and constantly seen in places where the details are better preserved. I picked up fragments of this mosaic in various places.

Still further to the west, first at Novi, and afterwards at other points on the coast, numerous remains of antiquity offer a promise of very interesting investigation when the country shall be more settled. At present, however, there is too little activity and progress in this direction to induce any search in the most probable localities, and the mouldering fragments must be left yet a little longer untouched, if, indeed, they do not serve as the quarries whence are brought the raw material for the construction of modern buildings and roads. Almost everywhere the remains, of whatever kind, are in such a state of dilapidation as to consist in reality of little more than fragments of walls and squared blocks of masonry. Occasionally when, as at Tenez, a modern town is built on the site of one of these ancient cities, vaults, cisterns, and even pavements are discovered; but it is difficult for any one who has not seen the

ruins to form an adequate idea of the perfect success of the Arabs and Moors in the work of extermination, and it is certain that here one can fully understand the meaning of the phrase *razing to the ground.* Here, indeed, the ruins form the soil, and it would be difficult to find a more expressive phrase.

Tenez is interesting for two or three reasons. There is a modern French town, neat, clean-looking, and tolerably extensive, built on a kind of promontory, which it exactly covers, and enclosed within a wall. Beneath this assemblage of modern houses are the bricks and stones employed by the Romans in the construction of their town, which was afterwards annihilated. Beyond, and on a small detached kind of island, though not surrounded by water, is the town of the Moors; and this is very interesting, as being precisely in the state in which it and all the other places on the coast existed till the conquest of the country by the French. It is, indeed, the only instance I have seen in which not a single European has ventured to intrude; not a street is widened or straightened, hardly a house (only one, I believe) has been altered to anything like a modern style, the squares, courts, gates, fountains, gardens, and mosques, are all intact, and the whole together enables one to obtain a real insight into the habits of these curious people.

The entrance to this old town is by a narrow mule-path descending from the high road constructed by the French from Tenez to Orleansville in the interior. Following this path, we soon come to the mud walls and the tower at the gateway. The entrance is on one side of the tower, through a Moorish arch of elegant proportions, and the road makes a turn at right angles before entering the town. A little hole in the darker part of the passage is the entrance to a kind of house, probably once, if not now, the habitation of the gate-keeper, and on passing through the gate one enters a moderate-sized square space, with a fountain in one corner, two sides of the square being provided with broad stone seats. Here, no doubt, was the place of justice, and here I saw squatting some dozen of the inhabitants of the town in their usual owl-like fashion, perfectly impassive, taking no notice of each other or of anything. Passing these, I at once dived into one of the narrow streets of the town, all of which are alike, consisting of buildings varying in height from 12 to 20, or perhaps 30 feet, all equally

white, badly built, and ruinous, each house having a large doorway, through which man and beast, children and poultry, alike entered, but not showing, except in a single case, a window, or other opening of any kind. The tops of the houses are flat, and used for drying fruit and vegetables. Each house has an internal court, and often a small garden, which one can see from above, as the town is built on ground rising very steeply.

The principal street runs in a tolerably direct line from the main gateway up to the mosque, which is placed at the highest point, and is, as usual, provided with its little tower or minaret, whence the people are called to prayers. There is nothing worth mention in the architecture; it is plain and simple. All the other streets are of the same kind as this main artery, except that in most of them some of the houses are in ruins.

Passing on from the houses to the top of the hill, where are the remains of ancient mud fortifications of considerable extent, I entered some extensive gardens, where vast numbers of the common cactus of the Mediterranean shores are cultivated for food. These gardens consist, however, chiefly of rough stones, which one can scarcely walk across, and which are separated from each other by heaps of similar stones of larger size. The plants are enormous, most of them 15 or 20 feet high, and they appeared to have been loaded with fruit. The fruit (the prickly pear) is not disagreeable, though of a flavour rather faint, but, except by persons thoroughly accustomed to them, it is really a serious matter to prepare them for eating. They are covered with tufts of needle-like hairs, which do not look very formidable, but which are worse to deal with than any natural defence I have yet seen to a fruit. The moment they are touched by the hand, these fine hairs enter the skin, and appear to multiply themselves indefinitely. They can hardly be pulled out, as they break at once, and remain more troublesome than ever. The pain they give is not very great, though annoying, and one is obliged to be contented to bear it for some hours, for every attempt to remove them only makes the matter worse. The vast number of large plants growing above this old Moorish town is a curious illustration of the habits of the people. Few fig-trees are seen, and hardly any vines, though both would certainly grow well with the smallest attention. But the prickly

pear requires no attention at all, and is therefore much better adapted to the country and people. It plants itself, it grows of itself, it fruits without any difficulty, and only requires that the fruit should be plucked.

From the old towers and walls surrounding the town, one has an excellent view of the interiors of the courts and little gardens, as well as of the tops of the houses. All is white, dead-looking, and monotonous. The town is of moderate size and seems pretty well peopled; and whilst regarding this unchanged habitation of the former masters of the country, one is naturally led to reflect on its condition some thirty years ago, when no European was here, except in a state of hopeless and degrading slavery, and when the town itself was a nest of pirates. It is interesting also to look back yet further to the time when the Spaniards were here, and represented, as they once did, a great and powerful nation; when the Portuguese were a great maritime people and occupied these shores; and when, before that, the Moors first came, with all their European habits and high civilization. But we may look back yet further, when the Vandals preceded these and destroyed the Roman power, which more permanently than any other had planted itself on the shores of Africa, and which, in its usual style of grandeur and magnificence, had signalized its period of duration by vast public and private works, which no succession of destroying conquerors has been able altogether to destroy. Of all its numerous masters, the Romans alone have really produced an abiding impression. It remains to be seen whether the French will be more fortunate than their predecessors, and whether, during their term of existence, they will produce an impression equally durable and more useful than that of Rome. At present they are advancing in the right direction, opening the country by good roads, and cultivating certain portions of it well and profitably.

The towns in the interior partake of the same general character as those already described. Orleansville is a garrison rather than a town, owing—not its importance, for it has none—but its existence, to its military inhabitants. To mention a few rows of small houses crossing each other at right angles, a small attempt at a garden near the entrance from Tenez, one square building surmounted by the crescent, and an interesting

mosaic of the fourth century, in very fine condition, requires but few words, but exhausts everything that can be said of this sultry, dry, dull place. I did indeed travel along the plains of the Cheliff with an inhabitant of Orleansville, who had found it a pleasant residence; but my companion was rather of a saturnine complexion, had smooth fat cheeks, and possessed a great talent for quietude and general absorption.

Between Orleansville and Milianah (a distance of about twenty-three leagues along the plains of the Cheliff), there are no European habitations except two caravanserais, and one or two houses and small villages near the towns at each extremity. These rich plains are still occupied and cultivated by the Arabs only. The town of Milianah is reached after a long ascent, and is found to consist chiefly of barracks, with the exception of a comparatively small and ruined district within the walls, near the centre of the place. The houses and streets possess a mixed character, and are not uninteresting. The town is watered by numerous small streams, and an abundant supply exists at all seasons. The neighbouring district is thus easily cultivated, and is covered with fruit-gardens. Compared with most of those I have visited in the province, it is a pleasant and rather lively place, with some few resources. An Arab quarter gives an aspect of variety, and a certain effect, without which the Algerian towns are singularly dull and uninteresting. A small but pretty mosque has been turned into a theatre, in which I saw a very poor vaudeville enacted by a company worthy of the piece, not of the place.

From Milianah, a highly picturesque road through the mountains, with fine views of the Zaccar peaks (about 5500 feet above the sea), conducts into the plains of the Metidja, and thence by Affroun, Mouzäia, and Chiffa, to Blidah. The three first-mentioned places are mere villages, consisting of a few houses spread over a wide enclosure, and constructed after a uniform system by the Government; being afterwards granted to colonists with land, on certain conditions. Blidah, however, is a much more important place; and is a mixed Arab and French town, though the general aspect is French. It is situated close to the mountains, about thirty miles south of Algiers, in an extremely rich and well-cultivated part of the plains, close to the gorge of the Chiffa, and not far from several places where copper and some

lead ores have been found. It is on the main line of communication from Algiers to the southern district of Algeria, by Medeah and Boghar, which must always be important military stations, and thus it will continue to enjoy a large amount of traffic. The land in the neighbourhood is extremely rich, and capable of the highest cultivation, and water is obtainable. At present it must be regarded as the second town in the province of Algiers; nor is it likely to lose any part of its importance. In the neighbourhood are good building materials, and slates; and there is a proposition to connect the town with Algiers by a railway, which could be done at small expense. Its buildings are not remarkable, but the whole place is lively and cheerful*.

Proceeding southwards from Blidah, we pass through the gorge of the Chiffa, and soon reach Medeah, another important military post; and interesting as showing still many remains of its former possessors, the Romans. The present town offers nothing worthy of remark. Northwards from Blidah, the road crosses the plains; and one can return by Algiers either by Douera, rising at once to the level of the plateau of the Sahel, or by another road more to the east, coasting the sandy hills, and gradually entering the higher ground by the valley. Douera is a pretty and flourishing village, well placed, but insufficiently occupied; and between it and Algiers are several other villages, which, from their position and the richness of the soil, should become important. By the other road, there are also many villages; and the whole of this part of the Sahel, if not sufficiently occupied and cultivated, still affords evidence that it has not been altogether neglected. Further west, towards the coast, are a number of small towns and villages, but all appear to have the same character.

On crossing the plain of the Metidja from Algiers to Blidah, the road passes through several towns, and westwards from Blidah to Marengo the country is well occupied. All the towns and villages are either enclosed with walls, or have a low earthwork and ditch to protect them from the night-attacks of the Arabs. Many of the principal places are regularly enclosed

* While these sheets were going through the press, accounts have been received of a serious shock of an earthquake which has destroyed some houses in Blidah. The whole of the valleys, and probably the mountains of the Lesser Atlas chain, are subject to disturbances of this kind.

and provided with watch-towers, while most of them have a sufficient force of soldiery to make use of these defences. They are now, however, perfectly safe from marauding expeditions, and the gates seem left open all night. As the fortifications, of whatever kind, required to be of sufficient dimensions to admit of some expansion of the village, there is usually a broad open space between the gate and the houses, which gives rather an air of desolation and discomfort; but the houses, when reached, are of fair size, decent, and even comfortable. The little inns and cafés are generally clean; and in all respects the very worst of these villages that I saw offered far more comfort and much better food than many large towns in Spain, while the better towns, such as Blidah, are supplied with hotel accommodation which might put to shame even the largest cities and the capital of that most uncomfortable country.

A very few words will be sufficient to give an idea of the small villages and encampments of the native tribes, which abound both in the mountains and plains, wherever there is space sufficient for the desultory and wandering habits of these people.

The habitations of this part of the population of the colony are generally dirty-looking and wretched. In the towns, an extremely small room, with an opening a few inches square for window, and a low door, provided with no furniture whatever except a broad bench round two or three sides of the room, serves for a dozen men to doze away their time during the day, and at night they appear to cover themselves with their blankets and sleep on the ground. In the country the huts are still more wretched. The villages of the better class consist of a very few square constructions, the outer wall on three sides being of unwrought stones or unburnt bricks. This wall is not more than four or five feet high, and the length of each side may be twenty or thirty feet. It has no openings of any kind. It forms the support of a shed open towards the interior of the kind of court thus formed, and the roof is of reeds, or some other available vegetable substance from the neighbouring hills or plains. The roof is generally of the brown colour of the ground adjacent, and the walls are replaced, wherever it is possible, by some slight elevation of the ground. Looking at such villages

from a little distance, the only appearance is that of a square hole, not unlike the shaft of a mine — this being the open part of the court. Within such a habitation, several families of human beings, with their horses, mules, donkeys, dogs, goats, and poultry, are herded together. Even the habitation of the Caid, or Chief, is little if any better; and a dozen such sheds make a large village,—the only kind of permanent abode ever constructed by the Berber tribes.

Much more common, however, than these villages are the temporary huts, constructed entirely of reeds, thrown together at short notice, and as easily left to fall to pieces. These are also of smaller size, being rarely more than ten or twelve feet long, about five or six feet high in the highest part of the exterior, and six or eight feet wide. They have no partitions, and are open on one side; the other sides being scarcely closed, except with dry leaves. Such huts are common enough, amongst certain tribes who usually inhabit the plains; and as they are too small to contain any such additional inmates, the horses and donkeys are not admitted. There are sometimes several huts together, but often only one or two.

The native encampments are more curious and picturesque than adapted to give much shelter, or any comfort. They consist of large pieces of cloth, generally black, supported and rather tightly drawn over poles of various lengths, giving an irregular outline, with several summits. They are extremely low, as the highest pole must not be longer than can conveniently be carried by a donkey; and when on the march it is curious enough to see the odd, miserable contrivances adopted for making these tents at once available and easily removable from place to place. A gipsy encampment approaches them in appearance; but the English gipsy is far more accustomed to shelter and comfort than the wandering Arab of the plains.

Living in these wretched and dirty habitations, reposing generally on the ground, wrapped up completely in their burnous or blankets*, restlessly wandering about on horses or donkeys from one place to another, sometimes cultivating the soil to a small extent, and waited on by their so-called wives, but rather female slaves, these people remain now as they were a thousand years ago; the principal inhabitants of a country

* See the costume as represented in Fig. 15, p. 193.

capable of the highest cultivation, and enjoying a climate generally salubrious, and often delightful. Whether the French, the present masters of the country, will so far adapt themselves to its peculiarities of soil and climate as to form the permanent inhabitants, and introduce an element of European civilization and habits into Northern Africa, is perhaps more than doubtful. The Romans tried it, and failed; although they formed settlements, constructed roads, cultivated the land, worked the mines, built numerous towns, and impressed upon the face of the country an image of their power and magnificence which will probably never be effaced. At the present day no doubt much is possible that was formerly impossible; but the French are not perhaps more likely to be successful than any of their predecessors.

It is indeed quite certain that the French are not a colonizing people. Unlike the Saxon emigrant, who generally strikes off at once to establish himself alone in some spot beyond any traces of civilization, and who often leaves his partially cleared or cultivated tract as soon as neighbours approach, to go yet further into the wilderness, the Gaul appears to prefer always some town occupation, and the people accumulate in villages in moderate numbers, but always in groups, and rarely on the extreme limit of the land open to them. There are in Algeria many more persons engaged in petty commerce of all kinds than in agriculture, and this, while it renders the country easy and pleasant to travel through, as ensuring comfortable accommodation at the villages, will long prevent that complete occupation of the land that can alone repay the great expense of life and treasure incurred in the conquest of the country.

In strong contrast with this population we find the native tribes, like the waves of a mighty ocean, ready at any obstacle to recede for the moment, but equally certain to rush back again into their former position whenever the obstacle is for an instant removed or weakened. It is comparatively easy to conquer them and occupy their land, but by no means easy to alter their habits and change their nature. They cannot well be got rid of, as they retreat into the interior of the country, whither they can hardly be followed; and they disappear and reappear as if by magic, and when least expected. They are now rapidly earning money by the sale of grain,

which they cultivate very easily, and bring towards the coast in large quantities; but it is difficult to trace what becomes of the money they receive. Most likely it is hidden, and thus withdrawn from circulation; and this is the more to be regretted as the greater part is silver—a metal much wanted at present. Perhaps some day this money will find its way into the European markets, to purchase arms and ammunition, by which, when the moment arrives, an effort will be made to re-occupy the country.

CHAPTER THE SECOND.

THE PHYSICAL GEOGRAPHY, GEOLOGY, AND MINERAL RESOURCES OF ALGERIA.

THE road from Algiers towards the interior at present passes through the villages and towns of Agha supérieur, Birmandreis, Birkaden, Boufarik, Béni-Méred, and Blidah, first crossing a low spur of the Lesser Atlas commencing near Cherchel, about forty miles west of Algiers, which forms the *Sahel*, or hilly country immediately round the capital. It then crosses the important plain of the Metidja, which runs for nearly sixty miles towards the east-north-east, with a mean breadth of about ten miles; and, after a distance of about thirty miles, the road reaching Blidah enters almost immediately into a grand mountain defile, formed by the Oued (river) Chiffa. This gorge conducts between the mountains called Djebel Mouzäia (5537 feet) and Bou Cheddou (5647 feet), two principal elevations of this part of the chain of the Lesser Atlas, and continues to rise rapidly towards the south, following for many miles the course of the stream. Leaving this, the road diverges to the west, continuing, however, to rise rapidly, until it crosses a singular ridge (the Dakla), on the south side of which, almost on the summit, is placed the town and military post of Medeah —the last town in this direction to which regular roads are completed. Beyond Medeah, however, is the town of Boghar (about twenty-five miles south, in a direct line), also placed on a very lofty elevation, and close to another principal range, attaining a height of 6100 feet at Djebel Taguensa, about ten miles to the west. In this part of the chain, therefore, there are two principal ranges, about thirty miles apart, running on the whole in an east and west direction across the province. There is also a third range, of much less elevation, close to the sea-coast. The principal, or central, of these chains rises considerably as it advances towards the eastern extremity of the

province of Algiers, and there attains an elevation exceeding 8000 feet.

Between the central and southern mountains, but to the west of Medeah, the valley of the Oued Cheliff opens out, and becomes very considerable, being in some places ten miles wide, forming an important feature in the country. The river rises far to the south, on the southern side of the mountains, and amongst the plains that extend between the Lesser and Greater Atlas; but, after running eastwards for a great distance, it crosses the southern range of the Lesser Atlas nearly opposite Djebel Mouzäia, not far from the point where the northern range is deeply cut through by the gorge of the Oued Chiffa. It then proceeds westwards to the Mediterranean, entering the sea at a point about midway between Cape Tenez and the Gulf of Oran. It receives a very large number of affluents, and drains an immense extent of country; but, like almost all the rivers in this part of the world, is extremely variable in the quantity of water it carries down, and is subject to sudden and great floods.

The Oued Chiffa, as I have already intimated, passes through a deep gorge in the mountains, near and to the north of Medeah. The watershed between this, the Chiffa, and some affluents of the Cheliff, is here very distinctly marked, and of considerable elevation, varying from 2500 to 4500 feet. The line of the watershed between the Cheliff and the northern district is, on the whole, rather irregular, though, in general, about midway between the valley of the Cheliff and the coast.

East of Medeah, the main chain of the Lesser Atlas is crossed by the Oued Isser, which, with its tributaries, drains a large extent of mountain country and plateaux of considerable elevation (2000 to 2500 feet), and enters the Mediterranean between Algiers and Dellys. The Oued Sahel, or Oued el Kebir, also crosses the range, running chiefly in a north-eastern direction, and entering the Mediterranean at Bougie (120 miles east of Algiers). Between the Oued Isser and this latter stream occur the principal elevations in the province.

The western portion of the northern range forms an irregular curved line of mountain country, commencing in the province of Oran, west of Tenez, running nearly due east as far as Djebel Mouzäia (5520 feet), near the point where the

Oued Cheliff opens out from the mountains and begins to take a west course. The chain then turns to the east-north-east, crossing the valley of the Isser; and, after being once more broken through by another smaller stream (Oued Sebaou), it terminates at the sea at Dellys. The central and loftier portion of this range I have already alluded to, and the eastern part consists of a mass of mountain country extending into the adjacent province of Constantine, and gradually diminishing in elevation towards the plain country.

Let us now return to that part of the district extending within the province of Algiers, between the valley of the Cheliff, the valley of the Isser, and the coast,—this being the country at present chiefly occupied, and also that within which my own personal observations were confined. I have described it already in a general way, with reference to the rest of the province; but it deserves to be considered in much greater detail.

This part of the country may be conveniently described as consisting of four principal subdivisions; namely, the mountain-tract to the west; the Sahel, or hilly district to the north-east; the mountain-district to the south-east; and the plain of the Metidja, which separates the two latter tracts of elevated land from each other. The Sahel is rather an undulating plateau, covered with sand in great part, and may be regarded as part of a range of elevated ground parallel to the main chain, and forming a kind of spur. At first, the hills are very inconsiderable; but they become higher near Algiers.

The general character of the Sahel, as seen from various points of the plain in the interior, and examined near Algiers, is that of an elevated broken tract intersected entirely by the Oued Chiffa (which takes the name of Oued Mazafran after its junction with the Djer). It probably nowhere attains an elevation of more than 600 or 800 feet, but within its range are many small valleys richly clothed with natural verdure, and occasionally well-cultivated.

The whole district, however, is capable of improvement, and though the soil is often light and sandy, is not without very rich tracts, wherever marls and calcareous rocks are mixed with the sand. Near Algiers the structure is very different, as metamorphic limestone and schists there come to the surface, and a

small development of gneissic granite has been observed close to the town. With these exceptions the rocks all belong to late geological periods, the overlying masses being very modern tertiary, or altogether recent. The underlying shales and other rocks, not having yielded fossils, are not yet clearly made out. They occur, as I have already said, very near the town of Algiers, and are well seen in a deep ravine where a dark-coloured blue limestone of great hardness, much resembling carboniferous limestone in appearance, and highly crystalline, is extensively quarried for building purposes and road-stuff. On the side of the ravine next the town, and near the gate of Bab-el-oued, another large quarry has been opened in a similar rock. In both these quarries the limestone is highly metamorphic in character. The porphyritic and gneissic rocks are of very small extent.

Proceeding southwards from Algiers by the gate of Bab-Azoun, the whole of the rock, cut through for the construction of the road and various public works connected chiefly with the fortifications, consists of a shale which has every character of the Devonian or Silurian shales of Northern Europe. For the first few miles these shales are occasionally seen, dipping considerably to the north. They are, however, concealed near the upper part of the hill by a pale yellow sandy limestone, probably dolomitic, and greatly resembling the magnesian limestone of the coast of Durham. This calcareous bed is of very modern date. For the most part the shales and limestones, though highly inclined, are regular; but near the top of the hill, not far from Mustaphe supérieur, they are seen to be elevated on an axis, and the dip is reversed long before we descend to the plains.

Proceeding southwards, a deep, but not very narrow, gorge is passed, which conducts to Birmandreis (about six miles), where the soil is extremely red, and it is evident that a good deal of iron oxide must exist near the surface. Near here a fine view is obtained both of the plains and the chain of the Lesser Atlas, the outline of which is highly picturesque. The village of Birmandreis is pretty, but quite French; it has every appearance of being in a flourishing state. From this point the road runs for some distance through a valley, and then again rises, crossing hilly ground of inconsiderable elevation, apparently well-

adapted for cultivation. Several settlements and a model farm are here established, and the village of Birkaden is soon seen, built at the foot of a hill, once across which we perceive before us the wide plain of the Metidja. The road passes for some distance towards the west before entering the plain, which is slightly undulating on the northern side.

The hills here alluded to are all of tertiary age, and some of them very modern. The rocks are gradually more and more horizontal towards the south, to which point they dip, and they appear to mark a partial and not very considerable upheaval of comparatively recent date. I have already mentioned that the breadth diminishes towards the west; and indeed from about twelve miles, which is the width of the Sahel near Algiers, the district gradually narrows, till, at its narrowest part (about thirty-two miles west-south-west in a direct line from Algiers), it becomes a ridge barely a mile and a half wide. After this it again widens, and begins to connect itself with the main chain.

At intervals, often inconsiderable, the wider part of the Sahel is dotted with villages, small towns, and cultivated patches of land. Although late in the summer at the time of my visit, there was little appearance of that extreme drought which is to be expected in this part of the world, and the valleys were well-wooded with trees of no recent planting. Numerous good roads cross the country, besides several horse and mule paths. A number of cattle, sheep, and goats are to be seen, and altogether there is every appearance of success in the operations of the colonists here. A good many complaints are heard of the harvest, and the fruit is poor in quality and small in quantity. All the vines that I saw had suffered from the grape disease (*öidium*), and I noticed that the grapes were most injured where the vines were trained high, or where they had not been sufficiently pruned to allow of the free passage of air.

From the Sahel we enter at once the plain of the Metidja, a wide and extended tract of land capable of high cultivation, but hitherto very partially occupied. It is nearly level, but rises a little towards the west, where it also narrows and is terminated, first by hilly ground, and then by loftier mountains. The natural limits are very distinctly marked, as the ground rises suddenly both on the north and south, though to very different heights; the Sahel, or low hilly district, coming in

to the north and west, while to the south the mountains of the Lesser Atlas chain rise almost directly from the plain. The natural drainage is not towards the sea in the direction of the greater length of the plain, which would be towards the east, but in various places across the hilly district to the north. The chief rivers are the Chiffa, with its tributary the Djer (called the Mazafran after the junction of these two streams), and the Harrach (Arratch), which enter the sea, the former on the western, and the latter on the eastern side of the principal elevation of the Sahel. There are also other smaller water-courses. Towards the western extremity of the plains, on the north side, is a lake of fresh water, of considerable extent in the wet season, but greatly diminished by evaporation during summer: it is called Lake Halloula.

The plain extends uninterruptedly from the bed of the Oued Nador (close to the small town of Marengo) in the west, quite to the Mediterranean, between the Oued Harrach and a small stream called the Boudouaou. The breadth at Marengo is only about two miles; but a short distance to the east, near the lake, the level ground is already more than six miles wide, and at the Chiffa ten. This width is continued, with little variation, to the sea. The whole content is between 30,000 and 40,000 acres. Towards the sea there is a good deal of marsh; and indeed, throughout the whole area, the water, rapidly entering, and not so quickly carried away, is apt to stagnate, and, in the early part of summer, when the heats begin and the waters are still in considerable abundance, very serious miasmatic fever appears to be common every season. It seemed to me that improvements in the drainage of the district, and the formation of more uninterrupted channels for the increasing waters, might avoid much of this; but it must not be lost sight of that the streams are all mountain-torrents, and frequently rush down headlong from narrow gorges, bringing with them an amount of detrital matter calculated to try severely the strength of any works that may be executed to guide or resist them. Like the ramblas or river-courses in the south of Spain, there is usually an extremely wide channel, through which two or three very small streams of water are seen in summer, and which then offer no obstacle to any kind of construction. When the rain comes, however, these streams afford no guide whatever

as to the direction the water will take. Bridges, dikes, and all kinds of constructions are carried away; the water often rises so as to cover not only its own bed but the country around, and each year a deep channel is cut in some new direction. A considerable amount of damage is done every season by the streams crossing the Metidja, in addition to the fever, which has more than once carried off an important section of the population in some villages.

The soil of the plains varies considerably, but for the forty or fifty miles that I have traversed it in various directions, it seemed everywhere capable of cultivation, and, for the most part, it is excellent. Towards the middle there is a good deal of black peaty mould; more to the west this passes into a red gravelly soil, and occasionally it changes to a dry grey stony soil, but it yields large crops wherever properly tilled. The greater part is still covered with brushwood and other low vegetation, but a vast quantity of the dwarf palm (*Chamærops humilis*) is seen for miles together, occupying the uncleared ground, and occasionally a rich covering of scented herbs, and numerous patches of wild olive and fig trees, give a breadth and variety to the scenery rendering it very pleasing. But it is not all smiling. Large tracts occur with nothing in the shape of vegetation, except, perhaps, a straggling growth of thistles, barely affording the scantiest food for the ass and the camel; and this thistle, of which the colour is nearly white, alternates only with the naked soil, or with a grass more hungry-looking and straggling than even the thistles themselves. Here indeed the character of the plains is that of a desert in appearance; but the fault does not lie in the soil. Want of water, and the total absence of any kind of cultivation, have produced the result, and cultivation combined with irrigation would soon bring about a favourable change.

Water has been obtained at various places at moderate depths, by borings and Artesian sinkings. Thus at Bourkika (where the road branches off to Milianah) there is a good and permanent supply at about eighty yards, and in other places generally at a smaller depth. The water of the Lake Halloula is reputed wholesome, and most of the river-courses bring down some quantity of water, however small, from the mountains. During part of the year there is an abundant supply everywhere.

The physical condition of the Metidja plain is curious and interesting, but the geological structure is somewhat obscure. While there is an absolute certainty that the whole of northern Africa, with much of southern Spain, has, within a recent geological period, undergone elevation to the extent of not less than 4000 or 5000 feet (and probably much more in places), we have in this remarkable level tract, not swept out by any large river, and having no marks of denudation, a curious and exceptional condition well worthy of careful study. It may also be noticed, in reference to the physical geography of the district, that the difference is essential between this plain and the river-valleys, such as the valley of the Cheliff, which, like many others of similar kind in all countries, is due to the eroding action of running water clearing away soft rock on either side of its course, and depositing detrital and alluvial matter. The plain of the Metidja is not a river-valley, and never can have been so, according to all present appearances. Its drainage is transverse and not longitudinal, although it inclines on the whole towards the sea in a longitudinal direction. It is not filled up with river detritus except where crossed by existing streams, and it has no character which can connect it with ordinary river-valleys. We must look further and deeper for its origin.

I have already remarked that the rocks forming that part of the Sahel or hilly district close to Algiers, repose on others of totally different character, highly metamorphic and greatly inclined. The tertiary rocks are also elevated, but are less highly inclined towards the plain, and there dip to the south, passing under the plain. The mountain district south of the Metidja rises, as I shall explain presently, almost at once, and the rocks are there nearly vertical. I have little doubt that the elevations of the various deposits to the south were earlier than those of the Sahel, and were very abrupt, being almost of the nature of faults. A sea-bottom nearly level, and derived from the soft material washed away during the rise of this mountain range, was probably formed at its foot; and at length another elevation in the same direction (east and west) brought up another portion of the same rocks to the north, leaving, however, a space of about ten miles undisturbed. Here slowly accumulated the marine alluvium which now forms the plains;

and on the final elevation of the whole district by a uniform upheaval extending over a great space of land and sea-bottom, the plains in question gradually emerged, small lateral and local upheavals throwing off to the east and west the rocks on either side of the north and south crevices formed during the first pressure from below, and governing the drainage established at a later period, when the sea-bottom became dry land.

We come now to the mountain district, extending, in the province of Algiers, from Tenez to the river Sahel, near Bougie, along the whole breadth of the province from west to east, being a distance of nearly 250 miles of almost uninterrupted mountain country, having an elevation rarely less than 3000, and often rising to 5000 feet, but occasionally exceeding 8000. Throughout this great extent of elevated land, the principal line of watershed is only once completely crossed by the ravines through which runs the river Isser and its tributaries; but there are not wanting other deep and important mountain gorges, of which that of the Chiffa is perhaps the principal. In proceeding from Blidah towards Medeah, the road is constructed up the valley of the Chiffa to a great distance, and only leaves it to pass over a high ridge of newer tertiary rock, on the other side of which the town of Medeah is constructed. From this place an old Roman road formerly conducted to Milianah, but is now not used. Medeah has been already mentioned as the last regular station of the French towards the south, to which roads and ordinary means of communication are fully available, and the old Roman road referred to is not at present used except for horses and mules.

After leaving Blidah, the road runs along the foot of the mountains for about five miles, to Chiffa, a village close to the river of that name, and then turns at once southwards, entering almost immediately the gorge through which the river passes. At this point, and for some little distance, the rock consists of a highly argillaceous schistose limestone or calcareous schist, not greatly disturbed, and which appears to pass into a true slate towards the east and north-east, at Ferrouka, where it is said to be extensively worked for slabs. The hills composed of this rock are well-wooded and highly cultivated. The limestone is very soon lost sight of, and is replaced by shales with hard calcareous bands dipping considerably to the north, and

changing a little in character and also in dip as we advance, so that it is seen inclining to the north-west on the left or west side of the gorge. I have little doubt that, on the other side, the dip is towards the north-east, and that the partial anticlinal thus formed is nothing more than the result of the greater action of the elevating forces along this line of cross fracture already established, and only enlarged when the ravine was in course of formation.

For about three miles of road (showing, perhaps, 3000 or 4000 yards of real thickness), the shales continue without much change, and then the dip again alters; a yellow, and probably magnesian limestone appears, the dip becoming south-west. Hard slates appear at a distance of half a mile, with a dip to the south of about 60°, and these are soon followed by other shales, much softer, and thrown into a vertical position, or even turned over slightly. There is for some distance a distinct development of these same rocks, always nearly vertical, alternating occasionally with extremely hard bands, and terminating with a considerable quantity of hard limestone, highly metamorphic, at the small transverse valley of Oued Merdja, which enters from the west at the foot of a high mountain peak.

The road is cut on the left side of the gorge at some height above the river, and gradually rises for a long distance. It is well-constructed and in good condition, but must always be subject to serious accidents in winter, when the torrents of water pouring down the bed of the river disintegrate and carry away the loose shale, of which there is a large quantity, and thus undermine the harder rocks, which fall, and carry destruction with them.

The road I have been describing cuts nearly at right angles through the whole of the rocks, extending from the commencement of the mountain district to the pass between the two highest points, called respectively Djebel Mouzäia and Bou Cheddou; the former to the west (5537 feet), and the latter to the east (5647 feet). From the valley of the Oued Merdja, the limestones and shales are continued, always with a south dip and very highly inclined; but a considerable thickness of river detritus occasionally masks the true rock. A little further on there are marks of great disturbance, and for some miles the

rocks are a good deal confused. They subsequently recover their regularity, become less highly inclined, and are affected by two or three anticlinal axes. In this space there is a great development of soft rotten shales, which, as I was informed by a local observer, showed unmistakeable evidence of being of the age of the Gault of England. This would at once mark the age of the great development of altered rock composing the mass of the Djebel Mouzäia range as belonging to the Lower Cretaceous or Neocomian period. There is, I believe, good independent proof that such is really the geological position of the series.

Still further to the south, the shales are covered up with nearly horizontal beds of yellow and reddish sandstone and limestone of a comparatively late tertiary date. These attain at Dakla, immediately above Medeah, an elevation of not less than 3000 feet above the sea, and are separated from the Djebel Mouzäia shales by some calcareous masses, of considerable importance in an economic sense. Two or three miles of intervening country in this part, and a still greater extent further to the west, are so completely cut to pieces by the action of the rain on the rotten shales as to present a very singular appearance. There is, however, nothing to prevent this district from being cultivated, and a considerable part is already under tillage, and appears to produce rich crops. On the south side of the ridge already spoken of, covered with tertiary rock, the town of Medeah rises, and the watershed is passed. We are then within the limits of drainage of the Chéliff, and the hills to the south gradually become lower and less important. At Boghar, the lower cretaceous rocks are replaced by a kind of chalk, belonging apparently to the uppermost part of the cretaceous series.

On the western side of the Djebel Mouzäia, I found the sequence to be nearly the same, as far as the less exposed condition of the surface allowed me to judge; and from the general structure of the country, which is exceedingly regular, there is every probability that the general order and nature of the stratification is pretty much the same. In this case the structure of the Lesser Atlas may be described in a few words, as a large development of lower cretaceous rocks, chiefly in shales, calcareous shales, and shaly limestones, elevated at a very high

angle, and often thrown into a vertical position by disturbances chiefly local, tending to bring up the older rocks towards the north. The main axis of elevation appears to be near the coast, and immediately north of the valley of the Cheliff, but very important subsidiary elevations occur to the south of that valley, and others of less magnitude to the north of the Metidja plain, and close to the coast.

Should this prove a correct view of the structure of the district north of the Desert, some results will follow which may prove important in an economic sense. In the first place, it will appear, that the whole range of the Lesser Atlas, with its subsidiary flanking chains, forms a distinct mountain system,—parallel, indeed, to the Greater Atlas, and parallel also to the Sierra Nevada in the south of Spain, but quite independent of either. In the next place, this mountain-chain will be an exception to most of those hitherto known, as it probably contains little igneous or old rock, and has no main granitic or gneissic axis. It is no doubt highly metamorphic near the central axis, and to the north; but the altered limestones and clays nowhere lose their stratified character, though sometimes passing into slates, penetrated in every direction with veins, and containing important systems of metalliferous lodes. The igneous rocks are chiefly basalts, occurring between Cherchel and Tenez, and small peaks of porphyry at Mouzäia, and near the Zaccar. It is, however, well to mention, that the basalts recur in considerable quantity to the east of Algiers, at Cape Matifou and Dellys.

In various places near Blidah, and to the south of that town, good crystalline slates and slabs, gypsum, impure marbles, and hard building stone have already been found, and are now quarried. At Mouzäia, on the south side of the mountain so called; at Oued Merdja, a few miles to the east; near Milianah, about twenty-five miles to the west, and at Tenez, much more to the west, but still on the same line, mines have been opened with more or less prospect of success, but all on mineral veins containing rich ores of lead and copper, and all in the metamorphosed rocks of the upper secondary or tertiary period. For the most part, these lodes obey the law so generally followed by veins worked elsewhere in older rocks; ranging east and west, or parallel to the main elevation, for copper, and north and south,

or transverse to that direction, for lead. There has been observed a great mixture of metals in some cases near the crossing of different systems.

The principal veins discovered, and those that have been longest in work, are at Mouzäia and Tenez respectively. The mines at Milianah I did not see, but I understood that they had been only recently opened. Those at Oued Merdja resemble in some respect their neighbours at Mouzäia, but are not so rich, and have also been very recently opened. There are copper mines at Oued Kebir, still nearer Blidah.

The mines at Mouzäia are situated on the south side of the mountain called Djebel Mouzäia, already alluded to. They are opened rather high up in the mountain, on both sides of a narrow ravine running northwards, and have been now (Sept. 1853) in operation more than ten years. At the distance of a couple of miles below is a village well-enclosed, and entirely dependent on the mines. From this village a cart-road of between five and six miles in length conducts to the high road, and the distance thence to Algiers is about fifty English miles by the present road, which is in all respects excellent. A railway is projected from Blidah to Algiers, and the distance from the mines by ordinary roads to the railroad would then be about twenty-four English miles. The present cost of conveyance from the mines to the port of Algiers is very considerable, and must greatly interfere with the prosperity of the workings.

There are several systems of veins at Mouzäia, the directions being rather irregular, but generally ranging from east and west to north-east and south-west, and the general character is tolerably uniform. Most of the veins are nearly vertical, and they appear to have contained ore quite to the surface, as a considerable quantity has been washed down by the streams.

The veins are harder than the enclosing rock, and thus commonly project beyond the surface and are easily detected. The veinstone consists of calc spar, heavy spar, and sparry carbonate of iron,—the latter often predominant; and the copper, whether in the form of yellow sulphuret (mixed with iron) or grey sulphuret (mixed more commonly with silver), exists in bunches not very distant from each other, and communicating by threads. Much of the ore that has been got, especially that from the

principal lode near the surface, was very rich, and a vein was discovered of remarkable size and value. Lower down, however, there is less regularity, and the vein, though it continues wide, now looks poor and ragged. The ore has been got by levels and stopes, chiefly from the lode in question, on which the level was at first driven. Lower levels were afterwards driven to cut the lode at various depths. The upper ones proved tolerably successful at first, and much good ore was extracted. The lowest one has not yet cut the lode. At its outcrop this main lode is from eight to nine feet wide, and contains not less than eighteen inches of solid ore (grey sulphuret of copper containing silver).

All the ore got from this mine appears to have been rich in copper, but its condition, as far as I could learn, has not been such hitherto as to command a ready sale at very paying prices. The company, at any rate, has not yet paid a dividend, nor does it seem likely to do so; but its present state is considered sufficiently promising to justify the expenditure of a considerable sum in opening the mines systematically. The operations as yet have been on rather a small scale, and if continued on the same scale, it would require much time to develope the mine fully.

Although the veins at Mouzäia are unquestionably rich, there are many serious drawbacks to success. The cost of labour must for a long time be very great, as the European mining population is small, and the natives are not only unaccustomed to manual labour of this kind, but are scattered and not easily kept together. The cost of all mining materials, but especially of timber, of which a good deal would be needed in the event of extensive and rapid works, must be enormous, and already, I was informed, the timber has to be brought from a great distance. Fuel also is hardly to be had, and water is not very abundant except during the wet season. All these difficulties must seriously affect the profits that would otherwise be ensured by the richness of the ore.

The ores at Oued Merdja and Oued Kebir are not so rich as those of Mouzäia, being chiefly pyritous; but the mines are better placed, and could be more economically worked. Nothing has yet been discovered here to justify great expectations, although concessions have been granted, and mining operations are in progress.

At present the mines near Milianah must be in a worse condition with regard to means of transport than those of Mouzäia, the distance from the coast being greater, and the communication less completely established. At the time of my visit, concessions were on the point of being granted for these mining districts.

The mines here are situated on and near the south flank of the principal mountain range close to the culminating points, and the elevations near Milianah being about the same as at Mouzäia, and within the range of metamorphic action, the lode, which is worked in tertiary rocks, is not a little interesting. It is worthy of remark, that the ore is not, as in most instances of copper found in rocks of modern date, in the form of carbonate, but sulphuret, although associated with crystalline carbonates (as of lime and iron), and occurring in a limestone rock. The enclosing limestone is indeed occasionally stained with malachite, especially where there has been any exposure to the action of water.

Other points at which copper ore has been seen in the district are on the north flanks of the main chain of mountains, at various spots both to the east and west of Blidah, along a line about thirty miles in length. Several localities in the Sahel have also been mentioned as cupriferous, but no important discoveries have been made.

The western part of the mountain district beyond the plains is less simple in its structure than that portion already described extending south of the Metidja. It contains two or three central points of considerable elevation whence extend radiating ridges, and in all probability basaltic rock will be found on examination to occupy some of these heights. With the exception of the mountains immediately behind Milianah, the highest points of the principal range are less than four thousand feet above the sea, and these are from ten to twelve miles from the coast. There is another range very distinct and nearer the shore, one point of which, called Lari in the map, five miles only from the coast, is stated to be 4190 feet above the sea, but the general range of height is under 3000 feet. A considerable mass of basalt appears to have been erupted in and near a range of no remarkable elevation between two deep gorges (Oued Messelmoun and Oued

Sebt), about ten miles west of Cherchel, the round fragments of the decomposed rock covering the hills and entirely obscuring any other rock (if any exists) near and at the coast. Beyond this, near the Oued Taremt, a mass of shale is developed, a good deal metamorphosed, and dipping east, with numerous quartz joints, often of considerable thickness, the greater number running east and west, and others, less numerous but equally distinct, having a north and south direction.

Thanks to the principal officer of police of Cherchel, as I have elsewhere explained, I was prevented from going from that town to Tenez by the steam-boat, and had thus an unexpected opportunity, which I was afterwards not sorry for, of making the journey on the back of a mule, with an Arab guide. Armed with a firman, or pass, from the principal officer transacting the Arabian affairs, I left Cherchel before daybreak, with about eighty miles of mountain country to traverse, very rarely visited by any travellers, and entirely without European settlers from the village of Novi, about four miles from Cherchel, to within a mile of Tenez. The journey occupies two days, starting each day before sunrise, and is really very severe, as the whole distance is extremely mountainous, and for the greater part of the way there is no road whatever, beyond the path worn by the feet of the mules, donkeys, and horses of the wandering tribes bringing their fruits and other products to the markets of Cherchel and Tenez. Much of the route lies close to the coast, but the latter part is a good deal in the interior, and the traveller often loses sight of the coast for hours together, passing over high ridges, or through deep valleys and ravines. There are numerous deep gorges through which water rushes down with great violence in the winter, and some broad open river-courses of considerable magnitude. The largest stream, however, at the time of my visit, would hardly cover the ankles at the deepest part, and might be jumped across without much difficulty at the widest. The principal gorge is that of the Dhamous, about midway between the two towns (Tenez and Cherchel), at which point I found sixty soldiers encamped, constructing a caravanserai to shelter travellers (if any should come) on this desolate road. It is hoped also that a village may arise in the midst of the mountain tract, as the land is tolerably good, and water can be had. Under ordinary circum-

stances, the traveller is indebted to some one of the inhabitants of the numerous native villages hereabouts for a night's lodging. I obtained that accommodation (such as it was) in the tent of the cantonnier, but I rather think I should have done as well with the Arabs.

Going out from Cherchel westwards, a considerable quantity of iron oxide is seen on the ground, often staining very deeply the grits and other rocks; and before reaching the basalt already alluded to, the schists, which form a large part of the series, are exceedingly rotten, and the stratification a good deal disturbed, being thrown off from south, the prevailing direction, towards the east and north. Afterwards, when the basalt is passed, the schists are harder, though still rotten, and appear to have a tendency to dip east, rendering it probable either that the basalt was poured out at a lateral crevice of rocks in course of elevation to the west, or else that later elevations in that direction have modified and even reversed the effect of the basaltic eruption. The distance apart of the two points is, however, some miles, and local disturbances are both numerous and considerable.

From the mountain of Lari (already referred to), and another at no great distance, an important line of north and south elevation may be distinctly traced, on each side of which basalt has been erupted. It is thus probable that the main east and west line of elevation of the whole district is the older of the two, and that this north and south line, which includes several lofty peaks, is of more modern date, and is the cause of the complication of structure and extent of metamorphosis that characterize the shales and grits, as well as limestones. This tract is well marked physically, being terminated by the basalts on the left or west side of the Dhamous, and those on the east of the Oued Sebt. These two streams descend through considerable ravines, the former reaching almost to the valley of the Cheliff, while the Oued Sebt, under various names, is separated only by a very narrow ridge from a third ravine which opens into the plains on the south. The intervening mountain mass forms a kind of nucleus or knot, containing four or five points of great elevation and several very high radiating ridges. One principal valley divides it into two parts.

The remarkable headlands, Taska ou Roumi, Kef el Arez,

and Irerrer Imkardou*, and several whose names I am not acquainted with, mark the termination seawards of some of these ridges, and give a peculiar character to this part of the coast. The first-named especially may be mentioned as a remarkable instance of a number of nearly straight headlands of no very great elevation running out for some distance into the sea, parallel to each other, and to about the same distance. They are not dikes, as might be expected, but portions of a hard ferruginous rock, probably a grit, which I had no opportunity of examining closely. Further on, at Kef el Arez, a compact pale blue and semi-crystalline limestone of considerable thickness forms the promontory, and appears to be somewhat disturbed in dip, though on the whole turned westwards. Still beyond, near the native village of Sidi Kaddour, hard limestone is again seen, after which, as far as the valley of the Dhamous, soft shales appear to prevail. The road here, passing down into the valley from the high land, is extremely steep and dangerous, and it is evident that the action of the weather is greatly felt in winter on the soft rock.

At many points between Cherchel and the valley of the Dhamous, tertiary rocks of various kinds are seen, and these have frequently suffered considerable disturbance and undergone great elevation. Coarse hard conglomerates, finer and looser sands, and calcareous beds alternate, and all point to the same general system of causes—a slow long-continued elevation, commencing when the sea covered the whole district, and lasting a sufficient time to enable vast accumulations of all kinds to be formed of the debris of former rocks. The condition of the older (chiefly later secondary) rocks is indeed peculiarly favourable for such action, as the shales are very easily acted on by water, and very extensive, while they are constantly alternating with hard limestones and grits of some thickness. It will easily be understood that the softer shales being eaten away rapidly as they came above the level of water and within its action, the support would be removed from these harder materials, and their rapid

* I take these names from the map, for the reason already given, but I found them hardly recognized by my native guide. It is, however, no easy matter to find out the actual names, concerning which, in many cases, no two informants would agree, while the spelling is always arbitrary.

destruction ensured. Evidences of this are very abundant and striking a little further to the west.

The basalt beyond the Dhamous occurs in a lofty ridge (Djebel Thouil), and the path lies along this ridge for several miles, descending at length into another wide ravine of the same character. Beyond this occur conglomerates of enormous blocks of stone cemented together, and these, after being formed and hardened, have been elevated, and then undermined. They are now seen in gigantic masses distributed over the beach. Further on, the hills, consisting of nearly vertical shales, are capped with horizontal tertiary sands, and at length we approach the prominent and imposing mass of Cape Tenez, which stands out from the general line of coast on the east to a distance of about a mile, but projects nearly three miles beyond the yet more receding coast on the west of the town. Immediately before reaching the Cape, the road passes across one of those singular ravines already alluded to, in which a mass of detritus several hundred feet thick, formed of angular blocks of all sizes, is cut through by the water, and presents in its bare vertical walls a noble illustration of the all-powerful influence of aqueous action when enabled to act for a long time under circumstances in any degree favourable. As often happens in such cases, the quantity of water now coming down, even in winter, appears utterly inadequate to act upon the great masses, which have, notwithstanding, been placed as we see them by its influence. It is only when we take into account all the various circumstances, and calculate the effect of aqueous action on rocks of unequal hardness in the course of very slow elevation, that we at all comprehend the value of those simple causes that have produced such gigantic results.

The first view of the rocks of Cape Tenez is extremely striking. We find a grand succession of limestones and shales, and perhaps some grits, presented in a natural section of nearly 1000 feet, the wall of rock being perfectly naked and nearly vertical. The dip is towards the north, as we enter a ravine to the west, so that within the ravine the rocks are broken through on the strike, and present themselves in horizontal lines, facing each other, but at different levels. On the south side of the ravine, which reaches down nearly to the sea, the rocks gradually recede, the outcrop of each forming a terrace sloping northwards

at an angle of about 30°, and the limestones projecting. This appearance may be noticed for about a mile, and then it dies away gradually, the lower ledge of limestone being continuous across the ravine, and the others closing it up by degrees. It would appear that during the elevation a broad and deep crack was formed, gradually worn wider and wider by the undermining action of the water on the soft shales, and terminating only when the elevation was complete. There is no fault to be traced, and the hard beds are perfectly observable, and remarkably uniform, not only here, but for some miles to the west.

After proceeding along this valley for about two miles, the path turns southwards towards the town of Tenez, passing through a valley of another kind, not less remarkable for its extreme beauty and rich vegetation, than the former for its grand development of stratification. I have nowhere seen a more exquisite piece of natural scenery than in this valley. It is not without the elements of grandeur, as the mountains on each side are lofty, and towards the upper part precipitous. The path lies along the bottom, and is very narrow, having, indeed, the exact width required by one mule in walking, and being cut deeply into the soft stone by the hoofs of innumerable mules, donkeys, and horses, that have traversed it for centuries. It is closely shut in for the most part by brushwood. On each side the hills are clothed with small pines of the freshest and most brilliant green, set off by the numerous darker green plants that abound in the north of Africa, such as the myrtle, the sumach, and many others, but most of all the dwarf palm. The birds were singing in the trees, and one, a wood-pigeon, jumped out from a bush almost at the feet of my mule, and remained there looking at me as I passed. There was water, and the gentle sound of the ripple over the hard uneven bottom was not less pleasing, and even more rare than the voice of the birds. The sky was unclouded, and the air perfectly transparent. No one was near to interfere with the charm, and the general effect was that of perfect calm and tranquillity. Towards the approach to Tenez the valley appears to terminate, and to be completely and abruptly closed by a wall of rock. At this point there are, however, openings both to the right and left, and taking that to the right, we soon come in sight of a few houses; and immediately afterwards the sea appears at the foot of the town,

which is picturesquely situated on a promontory, and is quickly reached.

Near this point at the outlet of the valley, and only a few hundred yards from the town, several mineral veins have been discovered; and several levels have been driven, and some shafts sunk, to prove their value. They have not, as yet, done more than render highly probable the existence of workable lodes of copper. Other mines near, but towards the south, are more advanced.

The mineral veins of the vicinity of Tenez are chiefly in the lower part of the same great series of tertiary marls so extensively developed near the Mouzäia mines. These marls are here seen to repose on a thick series of hard sandstones, and the veins have been found rich near the contact of the two rocks. A number of surface works, and a pit to the depth of eighty yards, have proved the condition of the veins in the shales at one point in this neighbourhood, a few miles to the south, and justify good expectations for the future. Two adjacent concessions, chiefly in the sandstones, include the whole of the mineral ground hitherto discovered in the valleys running east from the town. A small but constant stream separates the two concessions, which reach from the port of Tenez for nearly five miles towards the east, and are everywhere easily accessible.

About ten groups of veins have been discovered within these concessions, either in the grit or very near the contact of shale and grit. They would all have to be worked in the grit. They range variously, often crossing the valley and showing a mean bearing much more northerly than that of the mean axis of elevation. In all these cases the ordinary veinstone is sparry carbonate of iron and calcspar, peroxides of iron and regular soft ferruginous gossans being comparatively rare.

Of these various groups of veins, the most distant from Tenez that fell under my observation was only three miles from the town and port, and was situated near the mule-track to Cherchel, at the contact of shale and grit. It is well marked at the surface. The principal vein or lode is six or eight inches wide at the crop, consisting of sparry carbonate of iron with lumps of copper pyrites. It has been reached by a level, and sunk on to a small depth, but is not at all developed, nor is it likely

that operations so very superficial should show any marked result.

A second and perhaps more important group of veins is situated about three-quarters of a mile nearer Tenez. The principal lode ranges between north-east and north-north-east, and is from two to four feet wide. There are also several strings or feeders. The indications of copper ore (yellow pyrites) are here very satisfactory, but the operations hitherto undertaken are insufficient to give positive results.

Near Le Cabanou, a settlement and house still nearer the port, another group of veins has been discovered, one of which is certainly connected with a powerful lode. It is marked at the surface by a ridge of hard rock running north-east and south-west. Another lode is opened close by, apparently almost parallel, but no doubt belonging to the same group. Others probably come into these.

In a small ravine close to the port and opening out of the main valley is another well-marked and easily accessible group of veins, the principal lode bearing nearly north and south. This lode is traced at the surface by a powerful gossan consisting of a sugary calcareous spar with much oxide of iron, and numerous small lumps of copper pyrites. It has been entered by a short level, and the stuff removed looks promising.

Near the top of a hill close to the town of Tenez and a short distance from the former group, another lode has been reached. The indications of a powerful copper lode are here distinct and satisfactory.

Numerous small threads and strings, probably feeders to these or other lodes, have been detected at various points, and some have been partially opened. It may be sufficient to state generally that most of the mineral veins and threads which abound in these concessions, close to the town of Tenez, and near the contact of the shales and grits, give indications more or less marked of the vicinity of copper, but it must also be added that none of them have as yet been fully proved, or even so far followed as to justify a conclusion as to the state in which the ore exists or the condition of the lodes in the lower deposits or grits.

The mining concession of Oued Allelah is situated on the south side of the coast chain in a wide tract of rolling ground

reaching to the valley of the Chelif. At this point, hard limestones and altered shales have been elevated into a nearly vertical position, and are greatly disturbed. They are overlaid by tertiary rocks of considerable thickness, less disturbed and metamorphosed, but still often tilted at a high angle. The general strike of the various beds is a little south of east. The dips of all the rocks vary exceedingly near Tenez, in consequence of numerous local disturbances.

The lodes and groups of lodes proved in this property are numerous, strongly marked, and contain nests of copper pyrites of very good quality, often laid bare by streams or shown at the surface by the natural weathering of the shales. The vein-stone of many of the lodes is thus left either projecting in walls above the surface or retaining only a portion of the adjacent shales, and forming lines of hillocks, enabling the more important groups to be recognized for a long distance. One of these, opened by a shaft and already proved to some extent, close to the high road, is continuous for a mile or two, and seems to have been formerly worked by the Romans. The existing levels and shafts have already yielded a fair quantity of good ore, but they are commenced on a small scale.

The principal mine hitherto opened in the concessions of Oued Allelah is on a vein cropping out further to the east, and called the vein of Boukendack. It has been remarkable for the large quantity of rich ore (copper pyrites) obtained at and near the crop in the case of the principal lode and various feeders. There is also a good course of ore reached by a shaft sunk forty fathoms, and apparently capable of producing a large quantity of paying stuff. The ends and floors in the upper levels and the general character of the lode appeared very satisfactory. This mine has been for some years raising ore, and at the time of my visit a complete dressing-floor was in full operation. The quality of the ore is good and the usual yield very satisfactory. Besides this group and that already alluded to nearer the road, other veins further east (one of them showing grey copper ore) have been partially opened in the concession, and may hereafter be found worth working.

The prospects of success in opening the lodes alluded to above, close to the high road, are more favourable than can often be met with. There are numerous strings and feeders at the sur-

face, and an excellent gossan. A short depth below the surface this gossan begins to contain spots and stones of copper ore, often to a considerable extent. At a somewhat greater depth, both in a shaft sunk and in the gorge of a watercourse, a considerable quantity of copper has been obtained, and everything tends to render it probable that a rich deposit of copper is present at no great distance.

Some works have been executed and a claim made for a concession at Oued Bou Aissi, extending to the east and north of the concession of Oued Allelah. It is only approached by a mule-track over a very difficult country, but it contains several remarkable lodes and groups of metalliferous veins, some probably rich in copper pyrites, but others showing grey copper ore highly argentiferous, and mixed also with antimony, arsenic and other metals. The former are continuous with the lodes opened on the adjoining property, and might probably be worked with advantage if held by the same proprietors, but they would not at present justify an independent establishment. There is a very decided lode partly opened near the village of the Caid, probably containing valuable ores of the more common kind (pyrites). Beyond this are two points where mines have been proved, and in both cases the grey sulphuret is obtained.

The most important lode, and the only one that at present exhibits any remarkable feature, is that of Kef-el-Hamam, about three hours' ride from the mines of Boukendack and fourteen miles or thereabouts from Tenez, but not more than four miles from the sea at the Bay of Souhalia, to which, however, there is no road or path. The whole valley in which this mine is situated is without any European settlement, and has no means of communication with a shipping-place except by mule-tracks.

The lode of Kef-el-Hamam consists of a large group of veins or strings open towards the crop, and concentrating in a bunch of rich grey copper ore laid bare at a fault on the hill-side, at a considerable height above the valley in which runs a small but rapid stream. As far as can be determined, the lode ranges a little north of east, underlying towards the north; but there is at present very little to justify a distinct conclusion as to its bearing and underlay, as the works undertaken to obtain the ore at the surface have been too irregular and unsystematic to enable one to determine any true relations between the main

lode, if any exists, and the small strings and feeders here crossing it.

About two tons of rich ore have been obtained from the excavations at this point. It is nearly of the same nature as the ores found at Mouzäia.

Mining in Algeria will be found attended with some peculiar difficulties. Labour of all kinds is very costly, and skilled labour, especially for mines, is not only dear, but difficult to get. For various operations of dressing the ore, the natives have been successfully employed at Tenez to a considerable extent; but they have not yet been introduced into the mines. Fuel, timber, powder, tools, and indeed all kinds of mining materials, are also dear, and can only be obtained at prices that must inevitably interfere with the prosperity of the various districts. It is only those that immediately adjoin the sea, or communicate with some port at no great distance by available roads, that are likely to be carried on with advantage. Thus, of all the districts, Tenez is the only one that would justify, at present, a large capital and operations on a grand scale*.

A large quantity of iron ore has been observed at various places throughout Algeria. As, however, there is a total absence of available mineral fuel, and the ores are not remark-

* The cost of getting the ore at the mines of Boukendack has been, on a long average, about 52*s.* per ton of 20 cwt. of ore dressed to about 16½ per cent. The cost of dressing to this fineness (which is about a fair average of the whole) may probably be stated at about 30*s.* per ton, and the proportion of general charges 8*s.*; while the cost of conveyance to Tenez (five miles) and shipment may also be taken at nearly 8*s.* This brings the total charges on the Boukendack ores to £4 18*s.* per ton on board, and the freight being 12*s.* to Swansea, the actual cost of the ore delivered at the latter port would be about £5 10*s.* per ton.

There is no reason whatever why the charges on any mines opened nearer Tenez should be higher than these, while the cost of conveyance, and some other expenses, would probably be less considerable, and with a large establishment and several mines at work, a great reduction might be expected. At present European labour (chiefly French) costs from 3½ to 5 francs per day, the natives (Arabs and others) are paid 1 franc per day, and convicts may readily be obtained by application to the local authorities at a cost of only 75 centimes per day. There seems no reason to doubt that any reasonable number of hands might be obtained on these terms, and the Arabs have been found perfectly available for all operations in the dressing-floor.

able for their excellence, and unfit to compete with those of Elba and other known localities in the Mediterranean, it is unlikely that they will be much used. Manganese ore has been discovered, but is also unimportant.

For local purposes there are beds of rock-salt, saline springs, gypsum, cement stones of various kinds, and building material. All these add greatly to the interest and value of the country, but they are not likely to be exported.

On the whole, it appears that the province of Algiers possesses a fair share of mineral wealth; but there can, I think, be little doubt that its true riches exist in the soil. Its sources of inexhaustible wealth are not concealed, but are manifest at the surface. It would be well if the French people and their Government would turn their attention more to the permanent interests of the colony, encouraging legitimate immigration and the culture of the soil, and removing many unwise and mischievous obstructions to the internal development of the country that have hitherto been insisted on as part of the general policy of France. Algiers is not France, but a French colony. The passport system, instead of being made tenfold more odious and insupportable than in any country in Europe, might safely be abandoned altogether. The ports might be free, or the duties at least nominal, to all Europe as well as France; and all persons should be invited and encouraged to come and partake of the ample sources of wealth, for the full development of which European labour is the only requisite. The more Europeans in the country, the greater would be the safety, and the smaller might be the military expenses. The more trade advances, the more willingly will immigrants appear, and the more rapid will be the favourable result.

I would now add one word of advice to future travellers in Algiers, as the result of my own personal experience, which had nearly been bought at too dear a price. It is with regard to passports, which should never on any account be parted with, no matter who advises it, or what is said. The experience I speak of is as follows. Before leaving Algiers I went myself to the police-office, and saw the proper authorities. By their advice, and at their recommendation, I took a "*récepisse de passeport*," which, I was informed, was amply sufficient to enable me to travel about within the country, though I might be unable

to make use of the steam-boats along the coast. As I did not mean to travel by sea, I took their advice, and left for the interior. Totally unable to get any accurate information as to times and distances while travelling, I found myself at length at Cherchel, on the coast, and there learned that a land journey I had projected to Tenez would be very tedious and difficult, and that I should lose but little time, save great fatigue and some money, by waiting for the steam-boat. I decided to do so, but on applying at the proper time for my place, learnt that my *récepisse* was good for nothing,—that I could not possibly leave by the steam-boat without a passport,—and, finally, that the only person who could give me a passport was the Commissaire Civile.

I found this functionary in all the dignity of his bureau, and, I must add, without much of the politeness or consideration his countrymen are celebrated for. On making my request to him, I could hardly induce him to hear me through, and he flatly refused the smallest assistance. His treatment was uncivil enough to be called insolent, as he merely told me I might go back to Algiers as soon as I pleased, and had no business to travel without a passport*. Under these circumstances, I went to the office of the Arabs, to see if I could go by land. I found there a gentleman who was really anxious to help me, but he was bound to refer me to the police-office, to get at least a *visa*. Even this was refused, though politely; but I was then told that no one would interfere with me if I chose to go by land. I therefore arranged for a mule, and returned to the office of the Arabs, where I was informed that if even the Commissary of Police himself went out of the town towards Tenez without a permission, he would inevitably be arrested before he had gone two leagues. Had I not found the officer here (at the *bureau des Arabes*) really anxious to do what he could to help me, I must now have gone back to Algiers. As it was, however, he took upon himself to do without the *visa*,

* I had the satisfaction (?) to learn afterwards, that this chief officer of the police was regarded as *un vieux imbécile*, and was known to have been got rid of from one place to another, till he was supposed to be completely buried and harmless at Cherchel.

As it is hardly likely that half-a-dozen strangers will go to this place in a year, and the inhabitants are far too few and unimportant to be heard, this may be an excuse for incompetence and insolence.

and gave me the necessary document. Let no one for the future fancy that he is free when in Algiers. No country in Europe that I have visited is so difficult in the matter of passports, and it is prudent, if not essential, to be *viséd* every evening. Algiers in this respect is worse than Austria, for there is no uniformity of system, and you only find out you are guilty of irregularity when it is too late to remedy the evil.

There is yet another passport abomination in Algeria. It is assumed,—I presume as a compliment to the colonists,—that all persons who land in the colony intend to go away without paying their debts, and thus it is considered necessary that every person wishing to leave should give notice at least three days beforehand, in order that his name should be stuck up in some public place, and advertised for the benefit of those whom it may concern. Thus, on arriving at the town of Algiers on any given day, it is altogether impossible to leave for France, or indeed for any town on the coast, without waiting three clear days, and if, as is most likely, the steamer starts in the interval, the unfortunate victim must wait till the next, thus sacrificing at least a week. All these arrangements of course greatly interfere with the business and prosperity of the place, and put Algeria in the worst condition of a penal colony. If I add to this that the official people are, as a class, extremely uncivil and careless, I shall be simply stating the result of my personal experienco and careful inquiries on the subject.

If this very troublesome and serious drawback were removed, I know of few more interesting or pleasant trips for the month of September than a visit to the towns of this part of northern Africa, combining at present many of the comforts of civilization with all the peculiarities of a nomad race. It is an excursion perfectly easy, perfectly safe, not very costly, and adapted to all tastes. The naturalist, the antiquarian, the sportsman, the artist, and the lover of the picturesque, would each find ample material. There is no difficulty in going from place to place, and with few exceptions the hotels and inns are sufficiently clean and comfortable to give no ground for reasonable complaint. The one monstrous abomination is the passport system.

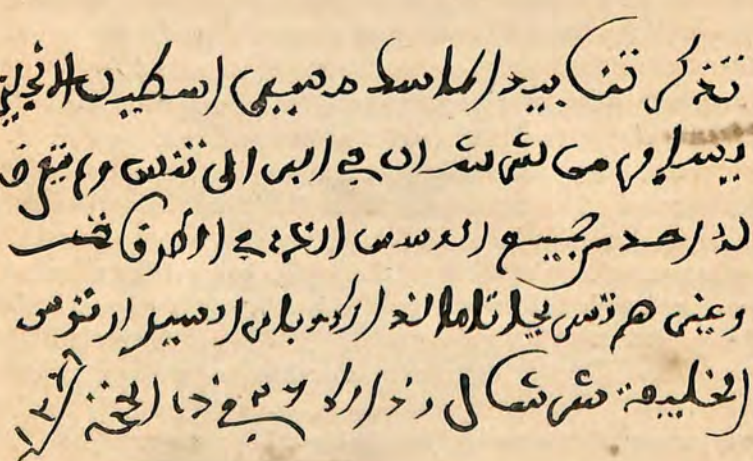
As somewhat of a curiosity of its kind, I append here (fig. 17) a fac-simile of the Arabic pass by which I was enabled to reach

Tenez by land. For the following translation I am indebted to the kindness of my friend Mr. Bonomi, who tells me that the handwriting is so bad as to offer considerable difficulty in making it out :—

"This our order, in the hand of the bearer, Monsieur Asten (Ansted), that he may travel by land from Shurshel (Cherchel) to Tunis (Tenez). Let no one of all the guards on the frontier of Tunis hinder, but let him have a completely free passage. For that purpose is this order of Said Artous, the governor of Shurshel. Zul Heja (the month of the pilgrimage to Mecca) the 26th, 1269."

Mr. Bonomi adds,—"The form of the seal is that which the Arabs attribute to Solomon. The name within the six-sided figure seems to be Abd-el-Wasa, the slave of the Infinite (as to space). In one of the triangular compartments there seem to be the figures '1881'; the others are occupied with mysterious signs and letters."

Fig. 17.—*Fac-simile of a Pass from Cherchel to Tenez.*



AMERICA.

I. NEW YORK AND PITTSBURG.

II. THE OHIO AND KANAWHA VALLEYS, AND THE COAL BASIN OF THE KANAWHA (WESTERN VIRGINIA).

III. THE ALLEGHANIES AND THE GOLD FIELD OF EASTERN VIRGINIA.

IV. SLAVERY AS AN ECONOMICAL QUESTION.

AMERICA.

CHAPTER THE FIRST.

NEW YORK AND PITTSBURG.

I LEFT Liverpool on the 15th December 1852, on board the "Pacific," one of the magnificent ocean steamers constructed by our transatlantic brethren to eclipse the equally fine, but not equally large, ships employed in the English mail service between Liverpool, New York, Boston, and Halifax. Owing partly to the ship and her machinery not being in the best sailing condition, but chiefly to the prevalence of storm-winds from the west-south-west, common at this season in the Atlantic, and of which we had more than our share, our arrival at New York was delayed nearly a week beyond the regular time, so that we only reached the harbour on the evening of the 31st. The extreme caution of a New Jersey pilot, who declined to proceed after dark, and managed to run us aground when induced to advance next morning through a thick fog, postponed our landing till nearly two o'clock on the 1st January, when we were safely deposited, with our luggage, amidst an amount of rain and fog, and in a degree of mildness of temperature, extremely rare at such time of the year.

New-Year's-day is kept by the New Yorkers, and pretty generally in the New England States, as a general holiday; occupied by the gentlemen in going round in full-dress to call on all the ladies they know or ever heard of, and by the ladies, in sitting at home, also in full-dress, to receive this homage. The shops we found all closed, and the town looked rather dull, very dirty, and not very tempting. I found, however, an excellent dinner at the hotel (Astor House) at which I put up, and learnt that the proprietors took this opportunity of paying a compliment to their friends by giving a better meal than usual, and providing

excellent champagne *ad libitum* without extra charge. As it is the practice in the States generally for each person to pay a fixed and uniform rate per day for board and lodging together, at all houses of public entertainment, which in fact rather resemble boarding-houses than our hotels or inns, this arrangement is not so extraordinary as it would otherwise appear. It was certainly very agreeable; as, owing to our long voyage, and the difficulty of preserving the flavour of meats in an ice-house, our appetites were such as to enable us to do full justice to the excellent venison and other delicacies served up. The price charged at the first hotels for board and lodging (except wines and liquors) is not more than about ten shillings and sixpence per day; and for this one may have breakfast at any hour, dinner, tea, and supper; and I must say that, here at least, no one need complain of the hurry of the dinner, or the difficulty of obtaining anything wanted. All that is needed is to speak to the waiter, and give him to understand that some prospective good in the way of a half-dollar awaits him if he looks after your interests, and he will then take care that you shall want for nothing.

Sunday morning dawned with a bright sun, clear atmosphere, and very hard frost; and I took advantage of it to cross in one of the gigantic and powerful steam-ferries to Brooklyn, which, with some other towns in Long Island, form a vast suburb to New York. From the low heights on this place, a view is obtained of the Hudson river, with a couple of small islands, and the tongue of land on which New York is built. Seen in this way, with a bright sky overhead, and in a pleasant clear atmosphere, some little justice could be done to the scenery around the city. It is more than pleasing, and has several points of picturesque beauty, besides that element of grandeur which I could now appreciate for the first time. New York has no docks, and it hardly requires any at present. The ships—including a large number of steamers—are moored in innumerable small recesses, formed by throwing out wooden frame-works, which, by their elasticity, act as fenders, and prevent injury to the ships entering between them. Thus the whole water-line is entirely occupied, and bristles with the prows of the ships, fastened like horses in these stalls, and ready to start at a moment's notice. The huge vessel in which

we arrived, drawing some twenty or twenty-five feet of water, upwards of 300 feet long, and 3000 tons burden, was packed away into one of these places, and on the other side of a little covered landing-pier, forming a warehouse, was one of its fellows in the service—the 'Atlantic.' Not far off, others of equal magnitude and power were lying, ready to start for the Gulf of Mexico; and many more, for various destinations. The mercantile steam navy of the United States, as illustrated along the shores of the New York peninsula, is one of the best and most striking indications of the nature of the people and the country. It all looks as if essential greatness was struggling with time. Much wants doing; but we only know how much when we consider what vast results have already been obtained, and we can only do justice to these results when we bear in mind what have been the efforts made and the difficulties overcome. It is not fair to form a judgment without considering all the circumstances of a case; and one has only to watch the rapid strides that are manifestly made in the direction of improvement, to feel convinced that many things which are now objectionable will disappear in a short time.

The street architecture of New York shows a curious mixture of Dutch and English styles. Without anything to remark on in detail, the first glance of the city gave me an impression that I had seen something like it before; and I soon found the antetype to exist in Holland rather than England. This is chiefly in the older part of the town, where the extremely varied style of the houses, the abundance of red brick, not only in walls, but as pavement, and many trifling but not uninfluential peculiarities, soon convinced me that my first impression was correct. In the main thoroughfares, of which the celebrated Broadway is the principal, the effect is lost by the absolute necessity that has arisen of rebuilding the houses from time to time on a far larger and grander scale than was originally imagined. For years to come this street will bear an incomplete and unfinished appearance, until every house consists of ranges of shops one above another, from below the pavement to the attics. It is easy to foresee the time when there will be hardly any residents in this part of the city; for, although the tongue of land on which the town is

built is extremely convenient for present use, and requires no large expenditure for docks, the inhabitants are already beginning to find, in the enormous house-rents demanded for very small accommodation, that such advantages must be purchased at a dear rate. The commerce of New York must remain within this narrow compass, and the only resource will be, and even now is, to heap shops and offices vertically, since they cannot be extended horizontally.

This part of America is favourably situated for cheap and good material for construction. Good bricks are readily obtainable, and an even-grained gritstone of dark chocolate colour is prevalent, and appears of fair quality, although of course but little idea can be had at present of its ultimate durability. It is very soft and cheaply worked, and can be cut into crockets and other gothic-work with evident facility. Its colour is peculiar, and in dark rainy weather, or a damp climate, would be disagreeably sombre; but with a bright sky overhead, this objection is not felt. Several of the large blocks of houses recently constructed, and now in course of building, are of this material, and I imagine its use must be increasing. Besides the sandstone, a very fine-grained, hard, and crystalline limestone, of perfect whiteness and great beauty, has been used for the principal public and some private buildings, and is locally called 'marble.' I have not seen polished or broken specimens, but it is beyond all doubt a most admirable stone. A variety streaked with green is also a little used.

The public buildings in New York that struck me as the most handsome, and in best taste, were, the Exchange, the Custom-house, and some others, in Grecian, Roman, and Italian styles of architecture. These are constructed of the marble above alluded to, and have retained their purity of colour and sharp edges hitherto. The churches of greatest pretension are of the chocolate-coloured grit, and are Gothic, but *very* florid. Besides the marble and sandstone, a fine-grained pale-grey syenitic porphyry is used in some large buildings, of which the Astor House is a good sample. There is no reason to doubt that this material is extremely durable, but it must be costly.

New York has excellent flagging, and some very good material for carriage-pavement. That commonly used in the old parts of the town consists of assorted boulders of various mate-

rial; all tolerably hard and durable, though irregular. Some attention to selection would more than pay the cost incurred, should any new paving of this kind be laid. The granite and syenite from the neighbourhood are employed in the construction of an excellent roadway through the principal avenue.

Several railways enter the town, and some of them convey passengers to its very centre. My ideas of the capacity of railway carriages were greatly enlarged on the first occasion of entering a public vehicle of the nature of an omnibus, drawn by two horses on a rail, within the city of New York. When I got in, the seats were nearly full, and other passengers continued to enter till there were twenty rather closely packed, and three or four persons standing at each end on a little outside platform and step. In my simplicity, I supposed we had our complement and should go on steadily, and was rather surprised when, on being hailed, our driver stopped his horse, and two gentlemen stepped up and came in. They of course stood, and presently some ladies were added, for whom the male portion of the seated inhabitants made way. So it went on, till the car that I had thought crowded with less than thirty passengers, was made to hold very nearly if not quite sixty. No one seemed astonished, and we arrived in due time at our destination. When it is considered that the car was not much larger than a Paris omnibus, and that no one was on the roof, the expansibility of the interior will be duly estimated.

Certainly the Americans are a travelling people. They understand it both in theory and practice, and their whole system is adapted to carry it out. Their country and themselves are equally intended for it. With more than 13,000 miles of railway actually completed, and a daily increasing extent opened for public accommodation; with an extent of steam-navigation almost inconceivable, from the magnitude of its operations and the rapidity of its increase; and with a people making full use of such advantages, there can be no doubt what the result must be. The style of the various conveyances, and the general rate of travelling, are also admirably adapted to the country. There are two classes, corresponding with the only two that can fitly exist under a Republican government, namely those who can pay to go fast, and those who are more anxious to go than careful about the pace. The carriages are comfortable, without

being luxurious; they are warmed, when required by the season; large and roomy, and communicating one with another; and if crowded, are so equally, for every one can walk through the whole range of carriages, and if he please alter his place to one which seems more comfortable. The stoppages are generally short, and no delay whatever takes place about tickets, for these are collected during the journey; while the luggage once given up, is kept in charge by the railway authorities, till, at the end of the trip, a servant or porter will readily relieve one of all further trouble, by taking the checks and bringing everything to the hotel. The meals obtainable on the route are plain, but sufficient; and having heard and read much of the troubles of English travellers in these matters when on the western side of the Atlantic, and having also travelled a good deal both in England and in most parts of Europe, I feel bound to state my impression that—making that allowance which is everywhere due to national peculiarities—our American brethren are at least as far advanced in the essentials for travelling comfortably by railroad as any people who have adopted that method of locomotion. As for steamboat travelling, they are immeasurably ahead, as I think all unprejudiced persons must admit; but this I shall come to presently.

America advances with such enormous strides in almost every direction, that each year must no doubt produce a marked difference in many respects; so that where a few years ago there was reasonable cause of complaint on the part of foreign travellers, there is now comfort and convenience. Thus it is that an account of the country and people will always have something that is new and fresh, even although other writers have gone over the same ground only a short time before*.

* At the time of writing this (January 1853), a new line of communication from Baltimore to Wheeling, on the Ohio, had recently been opened, from the Eastern States to the West, across the Alleghany mountains; and a branch was likely to be soon completed to a town a hundred miles below. A third main line is commenced, and will probably be very soon continued, crossing the mountains at the celebrated medicinal springs near Lexington, reaching the Ohio at Louisville, and thus opening a direct communication westwards, from Norfolk and Richmond, near the mouth of James River. Already there are two lines completed and one projected to the north, and three or four main lines to the south-west; while in the

New York itself being capable of extension only in one direction, the opposite shores of the two great rivers that meet at its extreme point are beginning to be thickly peopled, and have already become important suburbs. New Jersey on the one side, and Brooklyn on the other, are the two principal of these; and they are reached by ferryboats of gigantic proportions, admirably managed, crossing every three or four minutes through the day, and capable of conveying each time, with comfort, some 300 passengers, besides horses and carriages. In conformity with the general style of the river steamboats, there is far more attention paid to comfort than in similar cases with us. Large, airy, well-ventilated and well-warmed cabins are placed one on each side, and the rest of the space is under cover, so that the shelter from rain is complete. The engine is out of the way, and the steersman has a station aloft. The boats are steered across with unerring precision into a narrow recess in which they fit, and accidents are avoided by a continuous fender of moveable timber-framing lining the dock. Both New Jersey and Brooklyn are thickly peopled. The latter rises a little, and gives an admirable view of the harbour and entrance; while the former is more business-like and active. Among the objects of interest at Brooklyn are several churches, some of them rich and florid in their styles of architecture, while others are plain, but comfortable. I took an opportunity of hearing one of the western orators, Mr. Henry Becher, the brother of Mrs. Stowe, whose novel of 'Uncle Tom's Cabin' has attracted such great attention. The whole family of Bechers are well known for the peculiar talent, common to all of them, of giving vivid pictures of life and manners, and making picturesque and striking appeals, of which so many instances might easily be quoted from Mrs. Stowe's tale. I was greatly pleased

far West itself, there is rapid and complete railway communication to the middle of the State of Missouri; and the scheme of a Californian railroad, which appeared almost ludicrous when first mentioned a few years ago, is now seriously brought before Congress, and will perhaps very soon be in course of execution. Where, indeed, as in many parts of the States, there are few natural difficulties to overcome, and the principal expense is the cost of the rails, there can be no doubt that these great agents of civilization will take precedence of all other kinds of roads, and thus assist in settling the western country much more rapidly than could otherwise have been possible.

with the peculiar, though somewhat undignified illustrations by which Mr. Becher endeavoured to induce his congregation to support the establishment of churches in the far West. Being himself a native of those regions, he was well able to do so effectually; and, though I did not hear the result, I feel confident that his appeal was not made in vain.

I left New York after a stay of only about forty-eight hours, and made my way first to Philadelphia, where I slept, and afterwards proceeded early next morning on the road to Pittsburg. The road is not without interest, running westward upwards of 350 miles through a country, which, though at first flat or slightly rolling, soon increases in picturesque beauty, and at length becomes very bold where the road crosses the Alleghany mountains. Throughout the first hundred miles the country is studded with small white houses and large white barns, said to be remnants of old Dutch fashions. The rocks consist chiefly of granite and porphyritic rocks, greatly decomposed or rapidly decomposing. It struck me, that any buildings constructed of such material would hardly stand the test of time; while, on the other hand, the decomposed rock may probably have left behind it a legacy of fine porcelain clay, to make up in some respects for its unfitness for buildings. I did not see any proof of this, and merely throw out the hint for geologists who have more time at their disposal. The latter part of the road to Pittsburg was performed at night, so that I was hardly able to form any judgment of its nature, or of the country through which we passed. It was, however, manifestly very little peopled. During this latter part of the way, we traversed a large district of coal-measures which cover up the Devonian and older rocks in very regular order, and present themselves in this part of the field in very nearly the same state as that in which they occur further south and in the great extension of these deposits towards the south-west.

I reached Pittsburg on the morning of the third day from New York, intending to take ship thence and proceed down the Ohio. I was also anxious to see the country around, and make some inquiries as to the coal and metal trade of the place.

Situated at the junction of the Youghiogony and Alleghany rivers, immediately below the junction of the Monongahela and former river, and where the three unite to form the Ohio;

placed, too, in a district abounding with coal, and not very far from the great mineral regions of the north-west; there are few places in the States that have a better promise of advance and opulence. Fortunately for its progress, it is included within the State of Pennsylvania, although quite close to that of Virginia, which possesses a small narrow tract on the left bank of the Ohio, running up for nearly sixty miles beyond the general line of boundary of the State, with a width in some places of little more than six or eight miles. All around Pittsburg the country is affected by the results of coal-working and manufacturing; but the banks of the river must evidently be picturesque in the spring and summer, and the great streams of navigable water that unite in the immediate vicinity, add to the activity and importance of the position. The houses are built of red brick, and are already dusky and black; the principal streets are those running up at right angles to the river and the quay on the river itself; but there is little air of gaiety about, and I was told that business was dull. Before long, however, the high price of iron in England will cause a number of iron furnaces, already in the neighbourhood, to be put in blast once more; and, if discoveries of ore are made, and the coal is used with economy, no doubt this important manufacture will soon be independent of foreign competition.

At Pittsburg, in addition to the manufactures of iron, there are increasing and important copper works, fed at present (1853) by the supplies brought from Lake Superior. So lately as 1847, the ores thence obtained could not find a market; but all now raised is readily purchased for these works, and still the demand is not half supplied. I was informed that last year (1852) the make from Lake Superior ores alone amounted to 2500 tons, greatly to the profit of all concerned, including the miners, who appear to have already returned to the full extent the capital invested, and as yet are only beginning to develope the mines. Besides the ordinary uses of copper, this metal is also used in Pittsburg in the manufacture of brass, there being between thirty and forty brassfounders in the town. The cost of bringing down the ores from Lake Superior to Pittsburg was stated to me by competent authorities not to exceed ten dollars (42*s.* 6*d.*) per ton, the average yield of such ores being seventy-five per cent. The cost of carriage will be

reduced on the opening of the canal in course of construction between Lake Superior and the lower lakes. I was informed that this was nearly ready at the time of my visit.

It is stated that the population of Pittsburg, amounting, in 1850, to 46,601, is not continuing to advance so rapidly since the last census as at previous periods of its history. In 1800 it contained 1565 inhabitants, and in 1840, 21,115; showing an advance sufficiently important, though not quite so striking as some of the western cities. In 1850, however, it ranked as the ninth town in the States in point of population. Its inhabitants complain that they are injured by the recent changes in the tariff.

The great bituminous coal-field of the West commences near Pittsburg, and is largely worked on the banks of the great rivers which there unite to form the Ohio. The beds are nearly horizontal, and not only crop out at the surface, but are workable to so considerable an extent from the crop that little is known of deeper seams. The bed chiefly worked is a five-foot seam, yielding from 3000 to 4000 tons per acre. It is opened on the cliffs above the water-line, and, after an adit or level has been driven in the coal for some distance at right angles to the face of the cliff, a drift is cut, and a space of coal extracted of variable length and about seven yards wide. A vast number of such openings are made, but the adits have nowhere been carried very far in. The coal, when brought out on the hill-side, is usually run down an incline to the water, and there loaded at once in rough boats or flats prepared for the purpose. These flats are usually from 100 to 130 feet long and 18 to 20 feet wide, and are made of rough planks in the upper parts of the streams, where wood is still plentiful, whence they are floated down as punts, occasionally carrying goods. Arrived at Pittsburg, they are sold to the coal-owners at the rate of 1¼ dollar (5*s*. 4*d*.) per foot length. When to be loaded, they are placed under the ends of the inclines, and the coal falls into them through a hopper. As they are loaded and sink in the water, the sides are gradually raised by plank-framing till they draw six or even eight feet, containing then from 10,000 to 14,000 bushels (350 to 500 tons).

In this state, two boats are usually lashed together; and each boat being provided with a steersman and five boatmen,

the boats are drifted down the river. The coal is screened as it passes into the boat, and the small coal is saleable in the neighbourhood for manufacturing purposes, or coking.

The cost of getting the coal is estimated at three cents per bushel at bank (3*s.* 6¾*d.* per ton). The loading costs from half a cent to one cent per bushel (7*d.* to 1*s.* 2¼*d.* per ton), according to circumstances; and the further cost depends, of course, on the distance travelled. The usual wages of the steersmen are 1⅓ dollar (6*s.* 5*d.*) per day, and of the boatmen 1 dollar (4*s.* 3*d.*) each.

The value of the coal lands near Pittsburg is considerable, and rapidly increasing. Within six miles of the town, and with good river-frontage, the mineral rights have recently been sold at 500 dollars per acre, the land itself being valued at from 30 to 40 dollars. Twenty or twenty-five miles from the town, the value varies from one to two hundred dollars, and farming land, under part of which the coal is known to extend, obtains an advanced price quite in proportion to the value of the minerals.

The Pittsburg coal is hard and sound, without a great deal of slack, giving much heat, and burning readily with much flame. It is a first-rate gas coal, and also cokes well. It cakes slightly in burning, leaving a white ash, which in the finer qualities is by no means large in quantity. Besides the bituminous coal, there is also a cannel coal worked at Darlington, a point accessible by rail, and about forty miles north-west of Pittsburg. It is, however, regarded as of little value, as it does not yield an available coke.

Pittsburg is lighted with gas made from the coal in the neighbourhood. The coal yields, on a long average of some years' experience, 336 cubic feet of gas per bushel of 76 lbs. (equivalent to 9903 cubic feet per ton); but particular samples have yielded as much as 10,640 cubic feet to the ton. The gas company pay 4½ cents per bushel (5*s.* 7½*d.* per ton) for coal passed through a screen of 1½ inch, but only 2 cents per bushel (2*s.* 6*d.* per ton) for the smaller coal used in making the gas. The make in winter (1852–3) was 180,000 cubic feet per day, and the gas is sold at 2 dollars (8*s.* 6*d.*) per thousand to private consumers, and 1 dollar 26 cents (5*s.* 4½*d.*) for the public lights. The only valuable products consist of the coke, which sells for

4 cents the bushel (5*s.* per ton), and is considered to cover the cost of coal. The ammonia is not used; and the demand for tar being small, that substance is of little value. The gas is very pure, a bushel of lime purifying on an average about 14,000 cubic feet*.

From Pittsburg I took advantage of the Ohio, which was still open for navigation, and descended in one of those floating hotels that have been so often described, and are so interesting and national. I must confess that I felt and saw but little of the discomforts and peculiarities that I have frequently heard dwelt upon, and thought myself sufficiently fortunate in being able to proceed rapidly down the stream, able to look about and enjoy the scenery without being either frozen by the cold or annoyed by the smoke and disagreeable smells so common on river steamers of the ordinary kind.

It is not my intention, however, to detain the reader with merely personal matters, and I now conclude this chapter, comfortably housed on board the steamer, and making the best of my way to Point Pleasant, a small town at the junction of the river Kanawha with the Ohio, and the starting-point for the work I had in hand.

* I ought to mention here at the outset, that I everywhere found the greatest liberality on the part of those to whom I applied for information, and generally received a full reply, without mentioning the object of my inquiry. If our American brethren are accused, with some justice, of asking questions, it is only fair to say, that they are at least as willing to tell what they know, as they are anxious to increase their own stores of knowledge.

CHAPTER THE SECOND.

THE OHIO AND KANAWHA VALLEYS, AND THE COAL BASIN OF THE KANAWHA.

THE Ohio and all its principal tributaries, from the borders of Lake Erie, and the flanks of the Alleghanies, to where it leaves the State of Virginia, and for some distance also in the State of Ohio, run through a carboniferous basin, almost everywhere containing, close to the surface and in nearly a horizontal position, vast stores of mineral wealth, which in a few years must render this valley one of the richest and most important in the world.

Regarding the Alleghany as the chief feeder of the Ohio, the sources of the river are to be found on the borders of Lake Erie, at an average elevation of 1300 feet above the sea, and nearly 700 above the waters of the lake. Other sources exist in the Alleghany mountains, feeding the Monongahela, the Kanawha, Green River, &c., and others again in the State of Ohio; almost all these are nearly, if not quite, confined in their range to rocks of the same nature and the same geological age.

Thus the Ohio becomes intimately associated with the future development of this district, which offers everywhere the means of improvement and advance. The state of the waters of this noble river, the facts determined as to its course, and the possibility of improving its navigation, are at the basis of such advance, and must soon enter into the serious consideration of the inhabitants of the great cities of the West. The whole distance from Coudersport, near Lake Erie, to the city of Cairo, where the Ohio enters the Mississippi, is computed at 1268 miles, and thence to the mouth of that great Father of rivers, the water has to run on for another 1178 miles to the Gulf of Mexico. The first and least important part of this course is from Coudersport to Pittsburg, a distance of nearly 300 miles, during a great part of which the fall is at the rate of about three feet per mile. Below Pittsburg the fall averages

little more than five inches per mile to Cairo. Above the mouth of the Kanawha, the fall is much more considerable than it is in the rest of the course.

I descended from Pittsburg when the water was rather high, and the steamer stopped at various places for a short time, coaling near Pomeroys, at a place called Coalport, on the right bank, where the coal is got from the banks at a level of about 30 feet above the river. It took about twenty-one hours to reach this place.

The cliffs at Pomeroys are of grey sandstone, and the coal looks rather slaty, but burns well, being large, hard, clean, and without pyrites. There is about six miles of frontage, along which the beds are seen cropping out, of a thickness varying from $4\frac{1}{2}$ to $5\frac{1}{2}$ feet. Most of the regular steamers stop here and take a fresh supply of fuel, the larger ones taking about 50 tons, which is considered to last for 200 miles. The quantity of coal sold or sent from this point is considered to be 2,000,000 of bushels (70,000 tons) per annum, of which about one-third is supplied to steamers, and the rest sent down the river in flats.

Leaving Pomeroys about half-past nine, we reached Point Pleasant at a quarter to eleven A.M. It is a straggling village on the left (Virginian) bank of the Ohio, at its junction with and on the right bank of the Great Kanawha, having a good landing-place for steamers, with deep water at all seasons. At this point the Ohio is a noble stream, certainly nearly half a mile wide; and the Kanawha is also a deep, broad river, occasionally pouring in a vast flood of water during freshets. Coal is worked within a couple of miles of the town, but the seam is thin and the quality poor. The hills near are covered with small wood, and the country is under cultivation.

Quitting Point Pleasant in the evening, we reached Charlestown next morning, travelling by a small steamer navigating between the Salines, some miles above Charlestown on the Kanawha and the city of Cincinnati. We passed during the night the mouths of several considerable streams emptying themselves into the Kanawha. The town of Charlestown is straggling, but flourishing, and is said to have a population of 8000 to 10,000 people. From this point we obtained the services of a free negro called "the Doctor," who had a carriage and team, and who engaged to take us on to our destination.

Although the distance was only twenty-two miles, we found ourselves barely half-way at the end of five hours, and did not reach our resting-place till late at night. The roads were in a terrible state, owing to continued bad weather and severe frosts.

A few miles above Charlestown the road passes numerous salt works, for which this neighbourhood is celebrated. Brine-springs have from very ancient times existed hereabouts, producing salt-licks, to which buffaloes, deer, and other wild animals congregated, before civilized man took possession of the country. By boring through the sandstone rocks in many places to a depth varying from 400 to 1000 feet, the springs have been tapped, and a large quantity of brine obtained, besides numerous jets of inflammable gas. The quantity of gas was in one instance so large, that arrangements were made to utilise it. For this purpose the gas was burnt, and the heat employed to evaporate down the brine. The salt at present is very clumsily prepared; but the annual make is stated at 3,000,000 of bushels, and as two bushels of coal are needed for the preparation of each bushel of salt, it will be evident that in this way alone there is a large local consumption of mineral fuel*.

Having conducted the reader to a spot at which my movements were suspended for awhile, I may take this opportunity of describing in some detail the physical geography of the district, and the nature and economic value of the portion of the Ohio coal-field which it was my more especial business to examine and report upon. This portion was situated on the left bank of the Great Kanawha river, not far from the Falls, at which point navigation ceases. The remarks that follow bear chiefly on the limited tract I actually worked over, but they also apply to the extensive coal-bearing area on all sides.

The Great Kanawha river is one of the principal tributaries of the Ohio, having its chief source in the Alleghany mountains in the north-western extremity of North Carolina, at an eleva-

* It appears from official returns that this trade has not increased since 1836. As the salt is remarkably free from sulphate of lime, and especially valued for salting meat in the West, there can be little doubt that the sale might be greatly increased by proper management. The quantity seems practically inexhaustible.

tion of 1729 feet above the sea*. From this point, and under the name of New River, the stream proceeds with a nearly north course for 125 miles to Kanawha Falls, descending in all 1121 feet by a succession of rapids for the whole distance. During this part of its course it is fed by several tributaries, of which the Greenbrier and Gauley are the most important. Shortly after its junction with the latter river, it forms a fine cascade, tumbling over a ledge of rock to a depth of 22 feet, and descending into a large open pool near Loup Creek. From hence, where it first takes the name of Kanawha, it continues to descend for a further distance of eighty-nine miles without interruption, and finally enters the Ohio at Point Pleasant. The total descent of this latter portion is 86 feet, showing an average of less than a foot per mile, and offering no impediments whatever to navigation either by flat boats or steam-ships, except such as may be easily and permanently removed. It is understood that the charter of the James River and Kanawha Company, which gives a right to that company to claim a toll of 10 dollars for every boat passing down the stream, also requires that they should keep the navigation of the river open and clear at all seasons.

The mouth of the Kanawha is eighty-six miles below Marietta, 176 below Wheeling, and 264 miles below Pittsburg, all on the Ohio; it is 199 miles above Cincinnati, and the distance to New Orleans on the Gulf of Mexico is 1892 miles. From Point Pleasant to Pittsburg the mean rise of the bed of the Ohio is something more than 8 inches per mile, that portion between Beaver and Pittsburg rising at a steeper grade than the Kanawha, but the rest having smaller slopes. The descent of the Ohio to Cincinnati is on an average about 6 inches per mile, and thence to the Gulf of Mexico the mean fall is less than 3 inches per mile at low water.

It is known by actual experience that a descent of even 4 feet per mile in a stream is not incompatible with the existence of steamboat navigation, provided the supply of water be sustained; while, unless there be very great irregularity in the

* For many of the figures in this statement I am indebted to an admirable memoir by Mr. C. Ellet, "On the Physical Geography of the Mississippi Valley," published by the Smithsonian Institution, and dated 1849.

distribution of the fall, an average descent of 2 feet in the mile offers no difficulties that cannot be easily overcome. It is worthy of notice that the bed of the Kanawha, the mean fall being 11⅔ inches, is extremely regular for the whole distance between Loup Creek (near the Falls) and Point Pleasant.

The steam navigation of the Ohio, and also of the Kanawha, is liable to interruption from low water or ice, for a period which averages nearly three months of the year. The Kanawha commencing at the Falls, where New River terminates, is about as available for the conveyance of boats as any part of the Ohio above Point Pleasant. The periods of the year when the waters fall are variable, but there would seem to be little difficulty in so regulating the Ohio as to obtain a permanent navigation, at least from Wheeling. Should this be accomplished, there are no natural difficulties whatever to prevent a similar result from being obtained for the whole length of the Kanawha from Loup Creek downwards.

The Kanawha valley, properly so called, runs through rich alluvial bottoms, between hills rising very steeply on each side. The distance between the hills averages about a mile, and the width of the stream about 300 yards, not altering greatly for the first fifty miles below the Falls. Near the Falls the hills rise not less than 750 feet above the valley, but they gradually diminish in height going down the stream, till at a distance of about twenty-five miles the height is reduced to 500 feet, and at Charlestown (fifteen miles further) it is only 250 feet. There is nothing whatever in the form of the valley to prevent a railway from being constructed with perfect safety and at small expense, without heavy works, from the Falls to the mouth of the river; and in many respects it appears that the left or south bank would be the most convenient. This has accordingly been recommended by the State engineer as the best line for the Virginian Central Railroad*. The bottoms are cultivated and

* *Vide* "Final Report on the Covington and Ohio Railroad, by Charles B. Shaw, C.E.," published in the State Reports, Document No. 81. The engineer there writes, "All my calculations and reflections have resulted in the conviction, that the best and most practicable route for a railroad from Covington to the Ohio river is by way of the White Sulphur springs down Greenbrier and New Rivers to Kanawha, and by the south bank of the latter stream to its mouth." (p. 23.) The railway from Richmond to Covington is now nearly completed throughout, and by a vote of the State

produce abundant and valuable crops of grain and grass, and they are estimated to be worth from 50 to 100 dollars per acre, for agricultural purposes only. The hills enclosing the valleys, and the hollows throughout the district, are clothed with trees. Near the stream, and in other available places for readily removing large logs, the whole of the finest timber has been taken away, and young wood is springing up rapidly in its place; but further back, and in less approachable parts, the old timber remains. The poplar (tulip-tree), oaks (white, black and other varieties), ash, beech, black walnut, chestnut, white walnut, maple, hickory, birch, and in the hollows and valleys the sycamore, form the prevalent timber, and of these the oaks and tulip-trees may be regarded as the most abundant and valuable. Pines are not so abundant, though both heart and pitch pines are found.

Numerous tributaries enter the Kanawha between the Falls and Point Pleasant. The chief of these in point of magnitude are Coal and Elk rivers. The former, entering on the left bank several miles below Charlestown, is described as a somewhat shallow and variable though considerable stream, having a total course of not less than 100 miles, partly navigable by small craft, but much impeded by shoals. Elk River enters on the right bank of the Kanawha immediately below Charlestown, where it is crossed by a suspension bridge. It is a stream from 80 to 100 yards wide, running through a valley from 200 to 300 yards wide, and enclosed between hills from 300 to 500 feet high. It is occasionally interrupted by shoals, but is navigable for flats for some distance at most seasons. Its total course is about 150 miles, and it has several small creeks entering by narrow gorges. Besides these two principal streams, the Pocatalico has a course of seventy miles; Paint Creek runs for about sixty miles through a comparatively narrow valley, and Cabin Creek thirty or forty miles through a somewhat broader and more open valley. Considerable supplies of water enter the Kanawha from these and other creeks, especially after heavy rains. Owing to the course taken by these streams

Legislature of the 26th January 1853, the first instalment of a sum of 5,000,000 dollars was provided for the continuance of the line towards the Ohio.

and their tributaries, and the general direction of drainage of the country, the whole of the high table-land between the Alleghany mountains and the Ohio is cut into oblong or square pyramidal blocks, forming ridges or conical hills, from the effects of weathering. Many isolated hills are almost perfect cones*.

The population of the Kanawha valley is considerable, but has not lately increased very rapidly. The town of Charlestown at the mouth of Elk River is large but straggling, and from 8000 to 10,000 people inhabit the town and the right bank of the stream to the extremity of the Salines.

It is well known that Virginia is at present a slave-holding State, and the arrangements of any company working mines must be made with that in view. The general experience of the district seems to show, that with reasonable superintendence coloured labour can be hired with advantage to do the mechanical work of getting and hauling the coal. The average cost of such labour is about 2*s.* per man per working day. The cost of white labour is 3*s.* 6*d.* per day. Miners of various qualifications could be hired from the works near Pittsburg, where there is a considerable amount of coal-mining done; but the general style of work is uneconomical and unsatisfactory, so that it might be better to educate a class of superintendents on the ground adapted for the peculiarly simple and easy conditions of the country.

I was enabled to ascertain that the titles of landed property are easily proved, and may very readily be examined in the State of Virginia, the titles and all claims of the nature of mortgage being registered at the court-house of each county, and always available for reference. Fourteen years' undisputed possession under colour of title forms in itself a sound and inalienable title, except in cases of married women and infants.

The rocks on each side of the Kanawha and its tributaries, where not actually covered with alluvial soil, consist exclusively

* Not only the principal tributaries of the Kanawha, but the neighbouring streams, such as the Guyandotte River, traverse the coal district, and are thus equally well situated for laying bare the beds of coal which extend on all sides. The navigable state of the Kanawha, however, and the breadth of its valley, give this stream a great natural advantage over the others.

of coal-measures, which are nearly horizontal, but have a general dip towards the north-west of about 20 feet in a mile, besides small local dips throwing them slightly away from the valleys on each side of the rivers or creeks, and therefore towards the interior of the hills, thus making each of the blocks before described a kind of coal basin, of which the slopes are exceedingly gentle, all of them being towards the centre of the block.

From the eastern flanks of the Alleghanies, where the carboniferous beds first overlie shales and grits of more ancient date and metamorphic rocks, the prevalent rock is everywhere sandstone, which is generally compact and moderately hard, but contains some much softer and some very hard bands. With these sandstones are a few bands of rotten sandy shale with occasional false stratification, some more perfect and harder shales, some bands of black fire-clay, one of white pipe-clay, and numerous seams of coal. Masses or beds of peroxide of iron, often yellow and hydrous, cover the surface in some places to a thickness of several feet, and seem also to be occasionally bedded with other strata. Ironstone nodules are bedded occasionally near the coal. Calcareo-argillaceous bands, well adapted for hydraulic lime, exist at various points, and grey pyritous bands are also found. There is for the most part no surface-covering whatever to all these deposits beyond a thin coating of vegetable soil, derived from the decomposition of underlying rocks and an abundant growth of forest vegetation. In the river bottoms, however, there are rich alluvial lands, which are certainly of some depth, though probably not very great. Throughout the district there are no marks whatever of other disturbances than would result from the elevation of deposits already partly split asunder by crevices, produced by contraction during the first consolidation of the mass from a state of mud or soft sand. I nowhere saw in any part of the coal-field the smallest indication of faulted ground, or a single slip or trouble that could interfere with coal-working.

The whole district seems divisible into groups or subdivisions, each of which bears coal, though all are not equally valuable or productive. The lowest in geological position occupies the highest place geographically, and the strata forming it crop out on the flanks of the Alleghanies above the Falls. It includes several seams of good sound coal, amongst and below which

limestone occurs, purer and more distinctly bedded than is met with higher up in the series. It terminates upwards near the embouchure of Gauley River, and amongst its higher members are rocks containing common salt reposing on and covered by others capable of holding back water. It is in piercing by Artesian borings to this part of the series that the supplies of brine are obtained which have been already referred to, and which are worked in the valley near Charlestown. The thickness of this lower division I had no means of accurately ascertaining, but it is much more than 1000 feet.

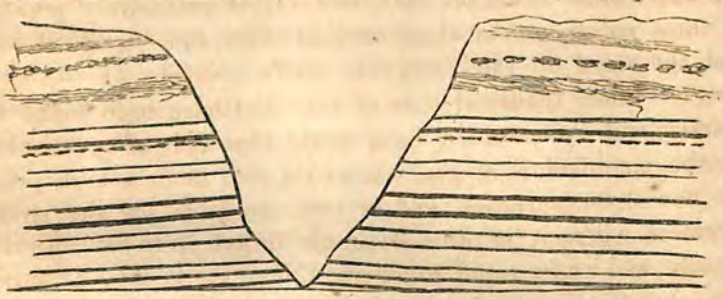
The next series, commencing near the Falls and terminating a little below Charlestown, includes upwards of 800 feet of deposits, more nearly horizontal than those below, and containing not only a great thickness of workable coal, but many seams of excellent quality, capable of being very easily and cheaply worked. Bands of hydraulic limestone, some ochraceous bands, and others from which iron could probably be obtained with advantage, an exceedingly compact cherty or flinty bed, known locally as the flint vein, and a well-marked and readily decomposing pyritous band, are all found in this part of the measures, and may be regarded as characteristic of it.

I examined minutely a property situated within six miles of the Kanawha, and visited the same seams of coal at a spot where they are now partly opened on the right bank of the Creek, by the Paint Creek Company. One of the most important seams, and that selected for first operations by that company, was a bed of very fine hard bituminous coal, locally known as a 'splint coal,' measuring 9 feet 6 inches in total thickness, at the end of the present drift, which at the time of my visit was 19 feet in from the hill-side. The thickness of the rubbish on the hill-side was here seven feet at a height of about 240 feet from the Creek. The same seam has been cut at the same level on the opposite side of the Creek, and has been opened sufficiently to show that it may be worked there with facility.

This fine bed of coal, having only about five or six very thin partings of black shaly substance in its total thickness, traceable at various points on both sides of the stream to a considerable distance, and dipping at so exceedingly small an angle as to be in fact almost horizontal, offers everywhere the greatest possible

facilities for extraction. Its floor is a pale grit with vegetable markings, and its roof a black shale covered with a very hard band of grit, between which and the flint vein is about 100 feet of sandstone, generally compact and of considerable hardness. The intervening space is also partly occupied by three other seams of coal, the uppermost of which is one of the bands of cannel already alluded to, and is extensively worked at Stockton's mine, on the other side of the Kanawha at no great distance. Immediately over the flint vein is another band of coal which occasionally passes into cannel; and above this again are other seams, only one of which is distinctly known, as the debris on the hill-side effectually mask the outcrop, and it has not been thought worth while, as yet, to prove the existence of beds somewhat difficult of access. Below the thick seam are eight bands of coal distinctly marked, the seventh of which, commencing from the Creek, appears also to be a cannel; but too little is known by actual workings to justify any further statement, than that several of the coal seams are sufficiently thick to pay for working. The annexed cut (fig. 18) will give some idea of the way in which these beds occur. The black lines represent the coal, and the flint vein is shown below the second coal seam from the top. The thick seam is the sixth from the bottom.

Fig. 18.—*Section of Kanawha Coal across one of the lateral valleys.*



There is in all a total thickness of upwards of 63 feet of workable coal in fourteen seams actually proved on the hill-side in one of these valleys above the water-level, and other seams are known to exist both above and below. The seams are of variable thickness, and occasionally affected by intruding masses of shale and grit, and it will be safe to estimate the total thick-

ness at not less than 50 feet. This estimate would give about 70,000 tons of coal to the acre; from which, if we deduct one-third for pillars, waste, slack, portions left in the mine, and other accidents, there would still appear to be upwards of 46,000 tons per acre actually obtainable. A very large and extended system of working may safely be ventured on in a case where the mineral property is so clearly developed and readily obtained as in that before us, and where the quantity of mineral in sight is so considerable.

The third or uppermost division of the coal-field, commencing below Charlestown, continues in a nearly horizontal position to the mouth of the Kanawha, and thence extends across that river into the State of Ohio. It is known to contain several seams of coal, a thin bed of inferior quality being worked about two miles from Point Pleasant, and other thicker and more valuable seams at Coalport. Much coal has been got from this place, but many of the old adits are destroyed, and the communication to the Ohio is thus interfered with. The coal from these beds is not of first-rate quality.

The workable seams of coal proved in the middle part of the series, and cut across by the Kanawha and its tributaries, are most of them of the ordinary bituminous kind, burning freely, with a moderate proportion of white ash, without sulphur, and well adapted either for steam or household purposes. There are also bands of cannel coal, now rather extensively worked at three points, one of them on Coal River, one on Elk River, and the third on the Kanawha, nearly opposite Armstrong's Creek. Some thousand tons of this coal have been taken to market, and there cannot be a doubt that it is of great value for the manufacture of gas. It would also fetch a high price for household purposes, and is even available for the river-steamers, where it is often desirable to get up the steam very rapidly, and where rapid combustion, however it may diminish the value of a fuel when estimated theoretically for heating purposes, is found to increase its market-price.

It will be observed that, in speaking of the coal, no notice has been taken of the depth at which particular beds may be looked for in different parts of the district. The fact is, that the large number of workable seams directly available above the water-level, renders it unnecessary to sink shafts at all.

A very long time must elapse before the cost of winning coal from day levels will be so far raised as to justify any other style of working.

It is not necessary to remark here at any length on the unusual facilities that will attend mining operations in this district compared with similar work in most countries, or to dwell upon its peculiar advantages. The latter are chiefly in consequence of the vicinity of a navigable stream, and the existence of a large number of workable seams, several of which could be operated on at once. The former arise from the absence of faults, the horizontality of the beds, the freedom of the coal from any troublesome liberation of dangerous gases, and the certainty that there can be no incidental expenses from incursions of water, owing to the position of the beds above the water-level. The expense of mining is thus more easily calculated and a smaller margin is required for extras than in ordinary cases, and the following may be safely submitted as an estimate of the charges of winning the coal and conveying it to market. The calculation is based on a somewhat high rate of wages, and advanced prices of some articles. It supposes that the near markets could be supplied by regularly constructed barges, towed by steam-tugs; and the distant depôts by flats, not brought back, but sold as timber. Ultimately no doubt the whole traffic would be by steam-tugs, but the other method is at present the more economical. I have estimated the cost of flats at a high rate.

	Cents.
Dead work and loss in mine, per ton of 28 bushels .	4
Getting the coal and hauling it to day	50
Conveying to river and putting on board . . .	12
Oil, lights, and sundry small charges	4
Net cost of coal on board . .	70

To this must be added, for all coal conveyed to a distance, the proportion of cost of boat and tolls on the Kanawha, say 40 cents per ton, and a charge for commission, depôts, wharfage, and storing, which may be taken at 10 cents. The total charge to be added for wages and further expenses of transport may be taken at 4 cents per ton for every 100 miles conveyed. This

would amount to 12 cents per ton at Cincinnati, 18 cents at Louisville, and 80 cents at New Orleans. Thus the net cost of the coal as put on board (excluding the cost of boat) being 70 cents, or 3*s.* per ton, the total cost, when stored at Cincinnati, adding one-tenth for risk of loss by river accidents, would be in English money 6*s.* 1*d.* per ton, in Louisville 6*s.* 4*d.*, and in New Orleans 9*s.* 2*d.* per ton. The extra risk on the distant trips would add some pence per ton to the cost of the coal at the Mississippi ports.

It might be supposed that this price could hardly be reduced by the employment of steam-tugs, but from the extremely small cost of such vessels, and the extent of business on the rivers, there can be little doubt that a large saving would really be secured by their use, while the amount of business done would be much increased. Even now the steamboats on the Ohio and Mississippi, burning for the most part wood, are enabled to carry flour and other goods at the rate of a quarter of a cent (one-eighth of a penny) per ton per mile, so that by proper arrangement on a large scale, the actual net cost of the coal at New Orleans might probably be kept below an average of 10*s.* per ton, and would be proportionably less at intermediate points on the rivers.

There are at present upwards of twenty very considerable towns, and a great number of smaller towns and villages on the Kanawha, Ohio, and Mississippi rivers. These are daily becoming more and more important, not only by a rapid increase in their population, but also by the establishment, in and near them, of manufactures of various kinds. The population of the three largest towns alone (New Orleans, Cincinnati, and Louisville) exceeds 300,000. The total number of inhabitants of the remaining towns and villages cannot be less than half a million. At a low estimate the consumption of coal for household purposes by this population may be taken at 285,000 tons per annum, provided a sufficient supply were always available at a moderate price. For gas and manufacturing purposes, the total quantity of coal required must be at least a quarter of a million of tons per annum.

There were at the commencement of 1853 upwards of 700 steam-vessels of various kinds navigating the waters of the Kanawha, the Ohio below Point Pleasant, and the Mississippi

below its junction with the Ohio. At the lowest estimate the quantity of coal sufficient to supply these, supposing them to average 150 miles per day for 180 days of the year, would amount to 1,250,000 tons per annum.

Through the city of Cincinnati no less than twenty-one lines of rail, having in all 2260 miles of road, are now in course of construction, and half the mileage is already completed. The supply of coal required for the depôts at and near Cincinnati, supposing two trains to run per day each way, would amount to at least a quarter of a million of tons per annum. Louisville, Evansville, Cairo, Memphis, and Vicksburg, all either are or will shortly be important centres of railway communication, and at each of them depôts for coal will be required. At present we may safely estimate the demand of railway consumption, including such supply as would be carried by rail to towns lying on their route, at a quarter of a million of tons per annum.

At New Orleans and Mobile on the Gulf of Mexico is an extensive and increasing ocean-traffic by steam-vessels, not only to all parts of the Gulf of Mexico and the West Indies, but with the whole Atlantic sea-board of the United States, and also by means of the Chagres and Panama railroad with China and the whole Pacific coast of America, including the present enormous trade with California. A successful competition in price with English coal could not fail to command this market entirely. The present market-price of coal at New Orleans is quoted at 7 dollars (29*s.* 3*d.*) per ton, but the average may be taken at 25*s.*, below which it can hardly go. As it has already been shown that any price at New Orleans above 10*s.* would yield a profit, there can be no doubt that 100,000 tons of coal per annum might be sold at great advantage for ocean steamers alone, and that this traffic is capable of vast development*.

In addition to the above markets, it must be remembered that

* The steam marine on the Gulf of Mexico in the year 1850–51 consisted of 12 ocean steamers, 95 ordinary steamers, and 2 propellers; tonnage 23,244. On the Pacific coast there were 37 ocean steamers, and 13 ordinary; tonnage 34,986.—[State Papers.] I have added nothing for the increase that must arise in this traffic should a ship-canal traverse the Isthmus. It cannot be necessary to point out the probable result as connected with steam navigation and the consumption of coal.

the Virginian Central railroad, already completed from Richmond to the Blue Ridge near Charlottesville, a distance of 107 miles, has been lately ordered, by a vote of the State legislature, to be completed to the Ohio, at public cost, by a route carrying it along the left bank of the Kanawha. This line will run past the mouths of the various feeders of the river, and will for its own consumption require a considerable quantity of coal. It will also convey bituminous and cannel coal along the line eastwards, and cannot fail to compete successfully in the coal trade in all the markets throughout Virginia, if not in Pennsylvania. The lowest estimate for this demand cannot be less than 40,000 tons per annum.

The following therefore is submitted as a fair statement of the natural demand per annum for the whole district, including the railway traffic of Eastern Virginia, the general traffic below the Falls of Kanawha to the Ohio, below the mouth of the Kanawha to the mouth of the Ohio, and thence to the Gulf of Mexico, taking into account only those towns that are situated on the banks of the rivers, and the communication by steam connected with and arising out of their position:—

	Tons.
Household consumption in towns	285,000
Gas and manufacturing purposes in towns .	250,000
River steam navigation	1,250,000
Railroad locomotives	250,000
Ocean steam navigation from New Orleans .	100,000
Virginia Central railroad and towns supplied by its agency	40,000
Total tons .	2,175,000

This quantity is about half that supplied during the year 1852 from all the mines hitherto opened in Pennsylvania; and it is worthy of notice, that in the development of this trade in the Eastern States, the average annual increase for about fifteen years past has been about ten per cent. of the previous year's consumption. The supply in 1825 was only 35,000 tons; in 1830 it had increased to 175,000; in 1840 it was upwards of 850,000; and in 1850 over three millions and a quarter. The coal of the Pennsylvanian district, however, had to labour under

many disadvantages, as not only was there a prejudice against its use on account of its anthracitic nature, but approaches to the coal-field required to be constructed, and involved for the most part a very large expenditure of capital in the construction of railroads and canals. Something of this may be understood by referring to the condition of the Delaware and Hudson Canal Company, who have a capital invested of upwards of a million and a half sterling, and yet have never been enabled to carry more than 800,000 tons of coal, of which only 500,000 tons were raised by themselves. This company has, however, enjoyed great prosperity; the profits of the year 1852, which, owing to competition and other causes, was considered highly unfavourable, having equalled $6\frac{3}{8}$ per cent. on the whole million and a half of capital stock.

There is not a doubt that, if a large capital were invested in the development of the Kanawha coal, it would not only be possible to produce coal as rapidly, and quite as cheaply as from any Pennsylvanian mines, but the coal could at once be brought to market at small cost, without the expenditure of large sums on canal or railroad to convey it to the point where the best price would be given. The coal thus introduced would not be exposed to foreign competition, except at New Orleans.

It is not, however, to be supposed that the sudden production of so large a quantity of coal as that for which there is a natural demand could by any possibility be immediately secured by any amount of capital invested. The present consumption of coal in the whole southern and western district referred to, does not in all probability amount to three-quarters of a million of tons per annum; that of Cincinnati alone being about 350,000, and the Kanawha Salines 200,000. The steamboats, the railway locomotives, and the inhabitants of the towns are, it must be remembered, almost entirely supplied with wood for fuel; many of the towns are not lighted with gas, and the manufacturers are unable to obtain the quantities they would willingly take. No depôts have been established on a sufficiently large scale; and the cost of good coal, even at Cincinnati, varies from 8 to no less than 25 cents per bushel (9*s.* 3*d.* to 29*s.* 3*d.* per ton). No statement can be imagined that would more strikingly show the advantage that

must attend the employment of capital to extend the production, accumulate stocks at convenient places, and thus equalize prices, and ensure a permanent and profitable business.

The existing coal interests that would have to be met are neither numerous nor on a sufficiently large scale to interfere with the development of any plans that may be thought advisable. The collieries on the Youghiogany, and elsewhere near Pittsburg, have no particular advantages over those of the Kanawha; nor are they either extensive enough or sufficiently opened to be able to increase their supply very rapidly. The nearest spot accessible by railroad at which coal is opened near Cincinnati, is 106 miles; and the lowest price at which it has been estimated possible by a projected railway company to bring it there for sale (allowing a profit of 7*d.* per ton to the collier), is 6·76 cents per bushel (7*s.* 11*d.* per ton), a price which would leave a good profit to the Kanawha collier. The supply from Coalport (Pomeroy's) cannot offer formidable competition either in quality or price, and the terms now asked for coal lands on and near the Ohio, even for comparatively poor seams of coal, are such as to check any large operations in that quarter*. It is also the case, as already

* I learn, from a published communication from Mr. Worcester, dated Cincinnati, December 10, 1851, that the average value of the coal lands on the Monongahela (near Pittsburg) is about 500 dollars (£100) per acre. The same authority states that the average wholesale price of Pomeroy coal at Cincinnati is 6 cents per bushel (7*s.* per ton), reserving the boats, and of Pittsburg 8 cents (9*s.* 4*d.* per ton), the boats included. The boats cost 250 dollars (£50), and contain 10,000 bushels (357 tons). At Cincinnati they sell for 50 dollars. The retail price of coal at this latter town varies from 8 to 20 cents per bushel in ordinary seasons (9*s.* 4*d.* to 23*s.* 4*d.* per ton).

The steamboats pay 4 cents per bushel (4*s.* 8*d.* per ton) at Pittsburg, and 5 cents (5*s.* 10*d.* per ton) at Pomeroy. The present yield at Pomeroy is about 90,000 tons per annum, one-fourth of the quantity being sold to steamboats touching at the port, at the lower price (4*s.* 8*d.* per ton), and the rest to towns at the higher (5*s.* 10*d.*). The cost of mining alone is 1¾ cent per bushel (2*s.* 1*d.* per ton), this price not including hauling or loading.

These figures differ somewhat (though not materially) from those given in a former page, as the result of careful inquiries by myself at Pittsburg. I think it best, however, to place both before the reader, merely stating that the difference of date (one year) will sufficiently account for the variation in some points. It is evident, that, for a long time to come, there is

shown, that for the distant markets the additional charge for transport by the river is not more than twopence per ton for every hundred miles.

Two companies have commenced operations; one on the Elk, and the other on Coal River, chiefly for the purpose of working and sending to market the fine cannel coals there found. Contracts of some magnitude have also been entered into with the proprietors of Stockton's mine, for the supply of the same peculiar variety of bituminous coal. A small company (the Paint Creek Company) is also now commencing operations on the right bank of that creek. The capital invested is trifling in all these cases, and is acknowledged to be insufficient in the two former. All of them, however, have very encouraging prospects, and there is not the smallest reason why all should not prosper at the same time by the natural development of the trade.

It is indeed utterly impossible that any such amount of capital as is at present engaged in the Western coal trade, or is likely to be engaged in it for some time to come, can raise and convey the coals fast enough to the market to cause competition. Paradoxical as it may seem, there cannot be a doubt that any very extensive operations, accompanied by a systematic opening of the trade throughout the rivers to New Orleans, would in all probability rather advance than diminish the price that might be obtained for coal. This is, however, easily explained; for until there is a certainty of continuous supply, the steamboats and railroads must obtain fuel at whatever cost from the forests, on which alone they can depend. The large quantities of coal that would have to be supplied, and the extent of the depôts that must be opened before perfect security would be felt, would require the lapse of some time and the outlay of considerable capital before contracts could be safely undertaken to supply even the river navigation. When this is once done, the miscellaneous market, however pressing, must either remain unsupplied, or the public must submit to pay heavily for accommodation. Meanwhile the general town market at Cincinnati is

ample room for all those interested in coal properties throughout the western coal district to develope their property to any extent without fear of the supply becoming greater than the demand.

of itself sufficient to occupy the attention of small producers for a long time.

I ought to apologise, perhaps, for this long and somewhat dry detail concerning the probable results of the development of this part of the great Ohio coal-field. The subject is, however, so important, and came so immediately within the range of objects to which my attention was directed, that I have thought it best to place the facts on record.

The structure of the country in the Kanawha valley, near and above the Falls, is similar to that lower down; but the ground gradually rises, and the banks of the river close in, and become more bold. At the Falls the stream is a succession of rapids, the principal cascade being about twenty-two feet, and the water running over ledges of hard grit reposing on softer beds which are constantly undermined. The recession of the Falls must be considerable every season, but there does not appear to have been much difference hitherto noticed in the form.

Among the coal-measures occur some clay bands that appear likely to be valuable, a few seams consisting of fire-clay, others of highly plastic potter's clay, and one or two of pipe-clay. There is also a band of hydraulic limestone. At one spot on Armstrong's Creek I observed two bands of ironstone; and elsewhere I noticed others; but the quality did not seem very good. At other points, however, within the mineral field, there are decided indications of the existence of bands of clay-ironstone of excellent quality. No doubt these will in due time attract attention.

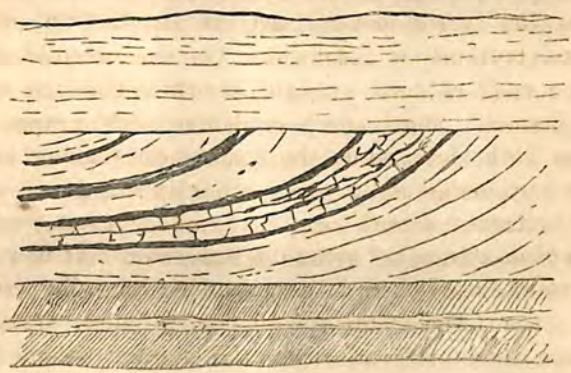
Further up, beyond the Falls, other deposits of ironstone occur, but these are chiefly rich hydrous oxides, of which I saw some extremely promising, close to the surface.

The coal-measures are fossiliferous, containing occasionally numerous remains of Sigillaria, Stigmaria, Lepidodendron, Calamites (these not so common), and various Ferns, particularly Pecopteris, Neuropteris, Glossopteris and Asterophyllites. Nuts are found occasionally, as with us, in a fossil state.

The coal seams are not unfrequently interfered with by intrusions of sandstone, often called by miners 'horses'; and sometimes, though less commonly, by clays and shales. In these cases the total thickness of coal is greatly diminished. I have seen some instances, as by the road-side near Paint Creek,

where the coal is abruptly terminated by grits. In another place I found a very good illustration of the direction of the drift of certain beds overlying a band of coal. Immediately over a workable seam, of about 7 feet, in Armstrong's Creek, was a thickness of beds of softish sand of about 12 feet, all inclined at an angle of 25° or 26°. Above were perfectly horizontal beds parallel to the coal. It was a hard bituminous coal overlying a shale, and with a little shale above it. The shale contained fossils, and many vegetable markings were visible on the grit. Another singular appearance of the measures in the same neighbourhood is figured in the annexed diagram (fig. 19).

Fig. 19.—*Illustration of the temporary dying out of a Coal Seam.*



On the upper part of New River lead is worked, and has been known for some time. It is not at present very accessible. Ores of the same metal are said to have been found on Gauley River.

Although the most valuable and best part of the western coalfield of Virginia appears to be naturally limited, partly by the middle part of the measures being richest in workable seams, and partly from the quality being best within certain boundaries not very well marked at present, there is yet no doubt that the productive field extends very widely, and occupies the whole of the large tract from the limestone in the first flanking range of the Alleghany mountains to the watershed on the right bank of the Ohio river. As, however, I did not visit the latter part of the tract, I can only mention it incidentally. Of the eastern part of the field, above the Falls of the Kanawha, and of the

country in that direction, I had, however, somewhat more opportunity of judging.

Immediately above the Falls, the valley of the Kanawha begins to close in, and at a short distance (about $1\frac{1}{2}$ mile), where Gauley River enters, and the river takes another name (New River), the width is already greatly diminished. Gauley River is here the largest stream, but it has had a much shorter course than the other. The turnpike road, after crossing Gauley Bridge, runs at first on the right bank of New River for some little distance (about another mile), but soon rises, and continues for a time ascending the hill-side by a road cut on the slope, till, at four miles from the Falls, it reaches the summit, and opens upon an extensive tract of broken table-land, which in fact is the natural level of the district, since the rivers and bottoms of the valleys are the exceptional parts. While the river remains in sight, it retains the same character as that just mentioned, steep sandstone cliffs hemming it in closely on both sides, while the water rushes along in a turbulent stream, occasionally, where a harder ledge than usual interferes, becoming a mere torrent, tumbling in fine rapids. In this part of its course the stream descends 362 feet in a distance of $27\frac{1}{2}$ miles, a change of level greater than the descent of Niagara River from Lake Erie to Lake Ontario, which in the same space of about 27 miles passes over the Falls and descends through rapids almost as sublime as the cataract itself.

The beds here, and for a long distance towards the mountains, remain very regular, and nearly horizontal, dipping usually at a small angle on each side, away from the valley, and with few soft or easily decomposed bands. As we advance towards the east, the coal-seams become somewhat more rare and further apart, though they still appear, and are occasionally worked.

After leaving the river valley, the road runs for some time near the edge of the gorge, occasionally affording glimpses of the scenery below, which remains of the same kind, and is exceedingly bold and grand. Close to the point where the plateau is first reached, a considerable quantity of land has been cleared, and in many places iron ore (hydrous oxide) of excellent appearance is found in bands from 2 to 8 feet in thickness, not far from workable seams of good coal. The land is here swampy, and discoloured by the abundance of the iron—a deep

yellow tint everywhere prevailing. At various places along the road, for nearly fifty miles from the Falls, the coal appears at intervals, and until we reach the mountains, the dips remain very small, and though locally varied, they have a general run towards the north-west. The last spot at which the river is seen on the road is near a projecting ledge of horizontal rock known as the Hawk's Nest—about 800 feet above the river, which pours its troubled and discoloured waters almost vertically below; so that a stone has been thrown from this spot to the opposite bank of the stream. The scenery from this, and several points where the gorge is visible for some distance, is extremely fine; and the country is described as having nearly the same character for many miles towards its source.

Leaving at length the valley, we come in sight of the mountains, crossing first those which flank, and soon reaching those which form the Appalachian chain. The first are singularly uniform, monotonous, and without character; consisting of the sandstone of the coal-measures much tilted towards the north-west, and succeeded by hard, compact, greatly altered limestone, weathered near the surface, on the eastern or scarped side of the hills. Some of the main ridges of this part of the chain, such as the Great and Little Sewell mountains, consist, however, entirely of the coal-measures, although the limestone first appears somewhat further to the west, and has been already mentioned as occurring near the mouth of the Gauley. I had no opportunity of observing the exact condition of these rocks, or whether, as is probable, the carboniferous limestone is interstratified here with the lower part of the coal-measures, instead of being, as in England, a totally distinct deposit, only occasionally coal-bearing, and separated from the more regular coal-measures by an intervening band of sandstone. I am inclined to believe that the whole carboniferous series, developed probably to a thickness of many thousand feet, is here throughout a coal-bearing deposit; in some places, no doubt, much richer than in others, but containing in its lower division many bands and groups of bands of metamorphic limestone and marble, fairly enclosed among and alternating with the sandstones and coals. The shales so common in Europe are rare, and if found are but poorly developed.

CHAPTER THE THIRD.

THE ALLEGHANIES AND THE GOLD DISTRICT OF EASTERN VIRGINIA.

THE last of the true carboniferous rocks are succeeded by shales and grits of the Devonian period, which are of considerable thickness. Commencing a few miles west of Lewisburg, where the main chain of the Alleghanies appears to the east of the Greenbrier Valley, the direction of the range may be distinctly traced. It presents a somewhat broken outline, although most of the elevations are regular, smooth, and almost continuous. The small valley immediately to the west of Greenbrier, and the Greenbrier Valley itself, afford good views of the chain, the opening being wide and the country thoroughly cleared; and, as we advance towards the eastern edge of this valley, where the river runs close alongside the mountains, and opens upon the bold and narrow gorge of Howard's Creek, all the peculiarities of form are clearly seen. One can also readily trace here the simple but effectual cause of the opening, along which the present coach-road runs, and which is evidently connected with the general structure of the district. Immediately facing the entrance of the gorge, a fine escarpment is seen, in which the strata appear bent into a fine arch, and on each side they are disturbed and contorted, thus laying bare the nature and mode of action of the disturbing force. The creek is entered at right angles to the Greenbrier River valley, but it almost immediately makes a turn, and then continues parallel with the valley, to which it is subsidiary. The scenery is a repetition, in a bolder and more picturesque fashion, of what has been already described as common in other parts of this district.

East of Greenbrier Valley we find no rocks but those of the middle Palæozoic period, which consist of such hard sandstones, quartzites, cherts, and shales, as commonly characterize this ancient epoch in most countries. The first appearance of them is interesting, as they somewhat modify the scenery, although this still continues more uniform and less broken up by disturbing

forces than is common in Europe, and more especially in our own country, in contemporaneous formations and in mountain districts. This arises, no doubt, from the much grander scale on which the movements appear to have taken place in the New World. A large portion of North America, extending from the Valley of the Mississippi to the Atlantic, was once, and for a very long time, the recipient of enormous quantities of vegetable matter, sand, and mud, afterwards to become coal-measures. This long period was marked by repeated depressions of the sea-bottom, during which, at first, a calcareous mud alternated with sand drifts, and these with vegetable accumulations, and in which afterwards the sand and vegetable matter continued to be thrown down, but without the mud. To this succeeded a period of repose, during which all the materials became consolidated, were modified, separated, and purified, and doubtless also contracted, and were fissured in various directions, remaining all this time under water. The period during which this almost perfect repose, and perhaps also the subsequent gradual re-elevation, took place, was occupied elsewhere by the formation of rocks of the secondary epoch, which, except in Eastern Virginia, do not seem to be represented in North America. But at length distinct upheavals commenced. A main line of elevation, running north-east and south-west, produced along a certain breadth of land a series of nearly parallel ridges, the result as it would seem of enormous pressure acting from the eastern ridge towards the west, combined with a resistless upheaving force. This, however, was the smallest effect. These ridges are not altogether more than a few miles in width, but in addition to them a vast breadth of territory was elevated in a broken plateau, or table-land, reaching westwards for upwards of two hundred miles, and gradually dying away towards the Valley of the Mississippi. Through various expanded crevices in this table-land, afterwards washed and widened by marine currents, we find a whole host of streams of fresh water making their way, varying in magnitude from the small mountain-brook to the noble and majestic Ohio, all conveying their tribute to the great Father of waters (the Mississippi) which absorbs them all, and which, after mixing them with the drainage of the lands to the north and west, conveys them southwards to the Gulf of Mexico. All the land thus elevated is

gently tilted towards the north-west, but is also affected by slight local peculiarities and modifications of dip, having reference to the fractures the rocks had already suffered during contraction and consolidation, so that a second and systematic series of fractures has been superimposed on those caused directly by elevation. Such appears to have been the simple but effectual agency employed in producing the interesting results already described. The elevations on the eastern side, especially towards the north, were differently, more actively, and more suddenly produced, and the whole country there being more mineralized, chemical agency has been more decided, and the coal, originally perhaps like that of the West, has been induced to part with its hydrogen and has become anthracitic.

In considering the elevation of this district, the structure of the various valleys and mountains is manifestly a point of great interest; and that of Howard's Creek, to which I have already referred, and which is sufficiently remarkable in itself as the valley of the "White Sulphur" springs, is certainly not the least interesting. Opening at first in the manner described, the valley continues rather narrow for some distance, during which it runs parallel to the general direction; but after a time it widens out considerably, and in a part where the mountains form a noble and beautiful amphitheatre, and where a remarkable isolated hill, or rather two such hills connected at the foot, occupy the central place in the opening, there occurs one of those sulphur springs, of which several exist within a circuit of twenty or thirty miles, and have long rendered this part of Virginia celebrated, not only in the United States, but even throughout the world. The spring in question (the White Sulphur) is the most fashionable and frequented of the whole group. The water is perfectly colourless and transparent, of uniform temperature, and has a very decided odour of sulphuretted hydrogen, though not to such an extent as to be at all offensive. The taste is equally decided. A deposit of sulphur is seen on the side of the well and on the rocks over which the water passes, and the water on being analysed has been found to contain carbonic acid, nitrogen and oxygen gases, and hydrosulphuric acid. It also contains sulphates of lime and magnesia, with other earthy ingredients*. The spring rises from

* See table of Analysis at the end of this chapter, p. 293.

the middle of the valley, near the foot of one of the hills above mentioned, which appear to consist of outlying masses of gritstone and shale dipping considerably towards the east. The gritstone is quarried as a building material, but is variable and poor in quality near the surface.

The road from White Sulphur through the mountains to the Eastern States, runs for some distance to the south-east, exactly across the main axis of the Appalachian chain. That particular ridge called Alleghany, and some others less important, I crossed in the night, and was only enabled to note their general correspondence with the others further west, and the absence, so far as I could tell, of what is usually called igneous rock*. A number of small saddles are seen in the various shales and grits, and occasionally altered limestones of the same series, but no violent contortions, or indications of sudden action—certainly nothing requiring the agency of heat. Grauwacke schists, nearly vertical, or dipping highly towards the east or south-east, mark the existence of a considerable elevatory power along the west central ridge, which is one of the loftiest of the whole series.

Between the Alleghany and the last principal ridge of the central chain there are numerous mountain ranges of smaller altitude and less extent. These passed, and the last principal ascent commenced, the character of the country is distinctly seen. It is bold, though not very varied, uniformly clothed with forest-trees, and less broken than is usual with so important a mountain-chain. The dip of the rocks (chiefly schists and slates) is pretty uniform, and to the south-east. The principal elevation crossed by the road is called Potts Mountain, and it must be of considerable altitude, probably upwards of 4000 feet. From its summit a magnificent panoramic view is afforded, ranging over the Alleghany chain towards the west, and including all the wild, intermediate, mountain-land; while, to the east, a noble landscape is presented across the rich and cultivated "Valley of Virginia," with the town of Fincastle about five or six miles off, in the middle distance, and standing up boldly beyond it a long extent of the Blue Ridge, of which

* The section given by Professor W. Rogers in his "Report of a Geological Reconnoissance of the State of Virginia" shows several anticlinals and faults, but no igneous and little if any metamorphic rocks. The general character of the elevation has been long known.

the Peaks of Otter are two conical or pyramidal mountain-masses that give a character of grandeur often wanting in this wall-like ridge of rock. I have seldom seen a finer instance of mixed mountain, woodland and agricultural scenery; and it was the more interesting and satisfactory to me, as confirming the view I had taken of the elevation-history of this region.

Crossing the broad and fertile Valley of Virginia, where the land is worth from 40 to 100 dollars an acre (a very high price in America, at a distance from large towns), and where iron ore, coal, marble, building-material, and perhaps other valuable minerals are abundant, I observed that the various rocks, chiefly limestones and shales, are at first nearly vertical, but gradually become more slanting. They everywhere, however, give indication of the fact that they exist in a disturbed region. The road crosses a small feeder of a stream which runs through this valley to the north. After meeting another stream coming south, the river breaks through a natural gap, and runs into the James River, near the often-described Natural Bridge, not far from Lexington; showing that the so-called valley is enclosed on all sides, and belongs essentially to the mountain-range, being in fact the principal plateau of the chain. Its elevation is very considerable; but it is rich and remarkably fertile, and is said to be well-farmed.

Beyond the Peaks of Otter the Blue Ridge descends, and permits a railroad to pass into the mountains from Lynchburg on James River. The cuttings on this line at once reveal the history of the mountain-chain, which is yet further developed as the country from Lynchburg down the James River Canal is glanced at in passing. The Blue Ridge is the porphyritic axis of the Appalachian chain, but instead of being the central, or even the loftiest of the mountain-ranges, it is the extreme east, and is often comparatively low. The granitic rocks extend east to some distance, and the whole country, with the exception of the river-valleys—which are covered with a thick coating of the richest alluvial soil, often extending over the uplands to some distance—is, in the strictest sense of the term, metamorphic, consisting of highly altered shales, schists, and occasionally perhaps limestones, traceable for a long distance, and reaching from the commencement of the disturbed rocks on New River to the town of Liberty, which is some miles east of the Peaks

of Otter. Thus it appears that the most highly altered rocks are not those that have been most elevated; but, as already suggested, these latter having been pushed through the others on a line of elevation of great length, have squeezed and contorted, and partly disturbed the carboniferous series near contact on the east side. The same elevation has also brought up to its present position all the rest of that vast range of these deposits which extends westwards to the Mississippi. The rocks, squeezed and contorted towards the east, and there partially covered up with deposits of newer date, have also undergone a certain amount of chemical change, resulting in the production of the narrow, elongated and highly-inclined anthracitic basins of Pennsylvania.

The course of James River from Lynchburg continues for about fifty miles parallel with the axis of elevation of the Blue Ridge, and distant from it about twenty miles. The rocks, wherever seen, are schistose and quartzy, and dip considerably towards the east, with more or less local variation. Further down, the river takes an easterly direction, and lays bare fine gneissic or granitic rocks, which appear to be somewhat extensively quarried for building purposes. The decomposition of these rocks by the weather results in the production of a fine and abundant soil, more richly and deeply coloured with oxide of iron than I remember to have seen elsewhere. No doubt there exist in the gneiss considerable veins of oxide of iron, and it is probable that the gold found in the district, and at present extensively mined, has been obtained from these irony and perhaps quartzy veins in granitic rock. The accompanying section (fig. 20) may assist in illustrating the preceding and subsequent account of this singular and interesting range; but it

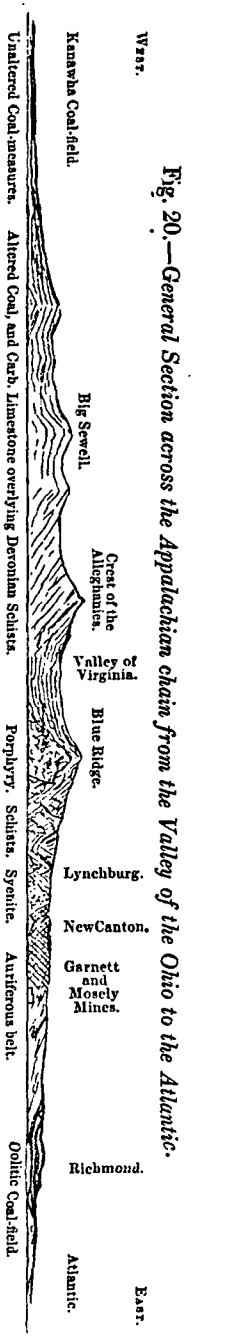


Fig. 20.—*General Section across the Appalachian chain from the Valley of the Ohio to the Atlantic.*

would require a series of engravings, and a long and minute description, to convey to the reader any adequate account of the condition of the rocks. The crests of the range are seen to bring out the metamorphic and igneous rocks towards the east, as already described.

Leaving James River at the town of Columbia, where there is a remarkable development of the oxide of iron, I entered at once the gold district, proceeding first to the Waller Mines, a distance of about ten or twelve miles to the north, my route crossing in a slanting direction the chief auriferous belt. For the greater part of the way the road runs through cleared agricultural land, a small tract of original forest greatly thinned, and a good deal of land once cultivated, but now left to become forest once more. In winter I found it bad enough, but no doubt it is very passable in summer.

A mine belonging to Commodore Stockton, now much worked, is about nine miles to the north-east of Columbia, and is entirely in land once cleared, exhausted by repeated crops, and since left for the wood to grow again. All the wood is very small. The veins are considered to be rich, and the principal one (Stockton's Vein) is worked to some depth. It is said, however, that the expenses of putting up machinery and managing the mine have not yet been returned. The contrivances, as far as I could see on riding through the property, were rather rough. Both here and in the neighbourhood of the Waller Mine, and indeed for some distance before reaching these mines, I saw abundant evidence on the road-side that not only had the streams and river-beds been washed for gold, but that a large quantity of white quartz rock had been crushed. The fields and road abound with large quartz fragments resembling boulders, and the ground is everywhere of the brightest vermilion red.

On the Waller estate I found that in the lower part, towards the south-east, the country consists of a very hard tough hornblendic schist, striking north-east and south-west, dipping at a very high angle to the south-east, and intersected by strong and well-marked joints bearing north-west and south-east. Between this rock and a fine granite, or rather syenite, which comes out abundantly at some distance towards the north-west, there appears to be a broken and varied series of quartz veins and soft broken schists, often highly micaceous, and

everywhere deeply impregnated with peroxide of iron. These sometimes alternate with veins of highly pyritous grit arranged in bands nearly vertical, which are parallel on the whole to the strike of the hard hornblende schists, and are also either parallel or nearly so to each other. Of these there are on the property three distinct groups of bands or veins, all auriferous, and very rich in gold in certain places. Washings were formerly carried on successfully in a small gully running through the estate, and on searching for the veins whence the auriferous sands had been removed, they were found distinctly marked close to the surface.

The first vein seen in ascending from the brook (Peter's Creek) is known as the Waller Vein, and here ranges west-south-west and east-north-east, being nearly vertical, but slightly underlying east-south-east, and very soft. It has been much and profitably worked to a depth of about thirty-five feet, when the necessity of pumping stopped operations. The surface has been worked to some distance near where the shaft was sunk. At a very short distance beyond, the Goochland Vein is shown by an open cutting, and is found to be a hard quartz lode bearing north-east and south-west, dipping south-east, and cutting the Waller Vein near the shaft where the largest quantity of gold was found. Still further up towards the north-west, another powerful quartz lode shows itself at the surface, but has not been opened. This is apparently parallel with the Goochland and crosses the Waller at no great distance. The Goochland vein underlies at a greater angle than the Waller, and the underlie of the other quartz vein is not known.

Between this group and that in the north-western part of the estate, there are a few costeaning-pits, and it is certain that quartzy and auriferous veins exist. Towards this north-western extremity is another group well-marked, but not so valuable at present as the Waller. It consists of five lodes, two corresponding with the 'Tellurium veins' elsewhere worked with advantage; one consisting of quartz, but presenting the appearance of a sandstone, and hence called the Sandstone Vein; and two of white tabular quartz, the Richmond and Moss Veins. Of these, the former seem to bear east-north-east and the latter north-east, both underlying south-east; but they are not very distinctly marked.

The 'tellurium veins' are close together, in a highly ferruginous micaceous schist extremely soft. The quartz of which they consist is hyaline, often tinted greenish or brownish, and between or near the band of quartz there is a very promising-looking band of pyrites. These veins are cut at about 25 feet down; and, as a general rule, I was informed that the lodes, of whatever kind, have rarely been found rich at or very near the surface. They have also been found to retain their value at all depths at which they have been hitherto reached.

An auriferous vein has been found in the rocks that occur south-east of the Waller property, but this is the last in this direction, as at present known; and there is also one, and one only hitherto determined, to the north-west, connected with the rocks of this district. Some few miles further west other lodes are known, but they have been little worked in Fluvanna county. Other veins at Tolersville to the north seem to be in rather different condition.

The general character of the so-called veins in this part of the country is that of irregular quartzy bands, varying in thickness from half an inch to several feet, enclosed in a highly ferruginous rotten schist, often having large plates of mica extremely rotten, and passing into a kind of marly sandstone of loose texture. Where the rock is of average quality, as it is considered to be in the best veins, the work may be carried on with the certainty of finding gold throughout great thickness of mineral, but in other cases the expenses of working are apt to swallow up all the profits, however large they may be, that arise from occasional rich portions, whether in shoots or nests.

I am inclined to believe, from what I have seen in this part of the mining district, that the whole of the so-called quartz and other veins are really nothing more than nearly parallel bands occupying a definite position, forming part of the great series of altered rocks on the eastern side of the great axis of the Appalachian chain, and dipping at a high angle away from that chain, throughout the whole country, from the State of Maryland to the final dying away of the axis in Georgia. To say that there are large alternating bands of hornblendic rock, quartz, and schists, describes this series in a general way. Hornblendic porphyry commences at the Blue Ridge, and is succeeded by a wide range of schists, occasionally, as near Charlottesville,

mineralized with copper and lead. Then succeeds a broad band of syenite; and next, beyond it, towards the Atlantic, appears a band of mixed talcose and micaceous schists; then hornblendic schists, sometimes very hard, sometimes extremely soft; rotten sand, intensely coloured with oxide of iron; quartz bands, varying in thickness from a quarter of an inch to several feet; garnet schists; highly pyritous bands, sometimes compact, but readily decomposing; soft dark blue talcose slates; pale yellow clay-slates; and perhaps other materials. These are probably all more or less auriferous, but certain parts, and certain mineral combinations, seem to contain much more gold than others. All these bands range in a north-east and south-west direction, dipping to the south-east at an angle varying from 45° to the vertical. Locally, the direction of the quartz or other hard bands undergoes change; and it is found that the coming together of two bands, or the presence of particular minerals, as oxide of iron or garnets, is favourable for the presence of more gold than usual, in small shoots or pipes, which occasionally are not only rich, but numerous and extensive. Lumps of gold weighing twenty ounces have been found, and from single nests gold to the value of from £500 to £2000 has frequently been extracted. Where, however, these richer portions are found, the average of the rock or vein is generally not increased, and perhaps the most favourable conjuncture is where several bands or veins usually bearing gold come near together, so that two, three, or more of them can be worked without inconvenience from a single shaft. The gold is either disseminated through very frangible quartz, spread in spangles on more hyaline and harder quartz, deposited in narrow crevices in soft blackish or red irony sandstones, disseminated in grains and small pepites in soft and micaceous irony sand, or spread undistinguishably through a mixed mass of sand, blue slate, pale yellow slate or schist, and hyaline quartz*.

Returning to Columbia, and thence proceeding up the

* Since writing the above, I have had an opportunity of examining a carefully-drawn geological section through one of the richest gold-bearing districts of California (that of Grass Valley). There is here the same alternation of hornblendic schists and syenites with quartz bands, the whole decomposed near the surface, and yielding much gold near the hard rock.

canal to New Canton, a distance of nine miles, I found, after passing the syenite and a considerable tract of schists, a distinct repetition of the auriferous rocks, comprising highly ferruginous sands, soft rotten schists, bands of quartz, sometimes more than a foot thick, garnet schists, both pale and high-coloured, and other rocks that appear to accompany gold. On inquiry, I found that gold had really been obtained in this neighbourhood to some extent, although it is not now worked. There was hardly any noticeable difference in the condition of the rocks here and near Columbia, and on examining the dip it seemed that this was reversed, so that although at first sight it appeared as if there were two auriferous belts, I am inclined to think that these two may have originally formed portions of one, which has been broken, and partly washed away, on the thrusting up (though to low elevation) of the hard syenitic rock now between them. Both copper and silver have been found at no great distance from New Canton in Buckingham county, and also near Buckingham Court House, as well as further north. I again noticed the prevalence of hornblende in these rocks; and observed at one place near New Canton a distinct hornblendic basalt here and there projecting, and appearing in concentric masses partly decomposed. This appears to form a band parallel with some thick and well-marked hard beds of grit and quartzy sandstone, exposed on the banks of the river. They have a distinct north and south strike, and are nearly vertical. Amongst them are some curious instances of garnet-schist, consisting of metamorphic argillaceous bands, also parallel to the bedding. It is not without importance, that these hard sandstone bands pass into and alternate with quartz bands parallel to them, and that this quartz is hyaline, and has in all respects the aspect and general character of the auriferous veins of the adjacent districts. I observed, with some interest, in this spot, the regular alternation of ridges, well marked by hills of brown and blackish tint, the somewhat lower grounds and hill-sides between the ridges being coloured deep red by the iron contained in the schists. I also noticed the frequent alternation of red irony soft schists and black or dark purple shales, extremely soft, and often showing a tendency either to pyritous concretions or garnets.

Proceeding from New Canton to the mines called Buckingham,

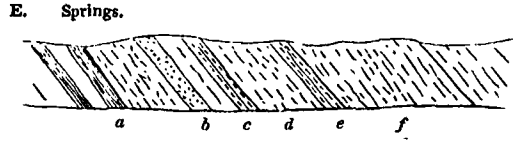
and thence to the Booker, or Garnett and Mosely mines, the road, running south-west, or nearly so, remains almost constantly on the crop of the great western auriferous band. There is everywhere abundant proof that the irony schists are close at hand, and the total decomposition of the rocks near the surface, together with the fractured and exceptional condition of the threads and bands of quartz rock, constantly attract notice. The distance on the road to the first mines worked between the New Canton mines and the Garnett and Mosely mines, cannot exceed twelve miles in a direct line. The first mines are those called Buckingham Mines, and those of Mr. Eldridge. The ore in both cases is an auriferous pyrites, occurring in a whitish or white schist. The vein is worked at a depth of 90 feet, or thereabouts, but has been proved to 160, and remains uniform. It yields about 6 dwts. of gold to the ton, and some silver. Of this there seems an indefinite quantity; and from the Buckingham mine there were obtained about 1500 ounces of gold in the course of last year. The expense of getting and reducing is estimated at 15*s*. per ton, but there is much loss. About twenty tons of ore per day are crushed and amalgamated on an average, the daily yield lately being 130 dwts. The establishment consists of several buildings and two shafts at the mine; and some distance below, near water, a mill and other houses. A large part of the expense is incurred in moving the ore from the mine to the mill. About 80 feet down from the surface threads of copper ore were found, consisting of copper pyrites mingled with the iron pyrites which forms the staple. These have gradually increased, but at present there seems little chance of any very important result for copper. In this mine the head wall consists of a pale schist, moderately hard, and the foot wall of a green chloritic talcose schist, rather soft. The rock strikes N. 30° W., dipping east about 85°, but often nearly vertical. Little oxide of iron appears here at any considerable depth below the surface.

Between the Buckingham and Eldridge mines, and the Garnett and Mosely, abundance of oxide of iron and quartz appear at the surface. The latter mines are opened on rocks about $1\frac{1}{2}$ mile east of the former, and probably belong to different bands of quartz. The strike is somewhat different, and the

dip much more considerable, amounting to as much as one in four for the first 100 feet from the place where the rock begins to hold together. The strike here is nearly north and south, ranging a little to east of magnetic north, and in some places changing to north-east and south-west; but this is probably connected with the existence of a very remarkable and abrupt ridge of quartzy rock, at a distance of about two miles east of Willis's Mountain, a mass of altered rock due to some local disturbance. Beyond this, in an easterly direction, but some distance to the south, the ferruginous stain and rotten schistose character of the rocks peculiar to the auriferous belts again appear, and the series is terminated by a broad belt of greenstone, having something of the appearance of basalt, and decomposing readily, in large concentric blocks. The strike of this greenstone is north-east and south-west, and it appears to dip towards the west. Still further on, towards Farmville, the auriferous character is once more presented.

The conditions under which the gold is found in the Garnett and Mosely mines are in the highest degree interesting and instructive, and are illustrated in the subjoined diagram, fig. 21.

Fig. 21.—*Section across the district worked for gold in the Garnett and Mosely mines.*



a. Rotten schists with pipeclay.
b. Steatite.
c. Principal auriferous band, called East vein.
d. Hornblendic rock.
e. Upper auriferous band (West vein).
f. Overlying beds.

The surface here shows a belt more ferruginous than the rest of the country around, ranging north-north-east and south-south-west, and dipping west. The actual breadth of this belt I had no means of exactly ascertaining, but it certainly exceeds 200 yards, and is probably much greater. It is, however, subdivided, including distinct bands of mixed quartzy threads and rotten red and yellow or greenish schists (*a*). On these repose bands of talcose or chloritic schist, which pass into an imperfect steatite (*b*), occasionally used as a firestone to line furnaces. All these are on the east or lower side of the series. In the middle, between the two well-marked auriferous bands

which next succeed, is a certain thickness of hornblendic greenstone (*d*), hard, and tolerably compact. The eastern auriferous band has been extensively worked at the surface, and recently has been sunk upon to such a depth, that the character of the rock, and the circumstances of its auriferous contents are well shown. The ground has been opened to the depth of thirty feet; and, for the most part, the whole of the portion yielding gold, six or eight feet thick, has been removed along a distance of about 400 yards; and, after an interval of 300 yards, other excavations have been commenced and carried on in a similar way in an adjoining estate. The Garnett mine falling into new hands, while in this state of development, the surface excavations were checked, and regular mining operations commenced on the eastern extremity of the vein, close to a shaft sunk in the adjoining estate to the east, now forming part of the property. These two shafts were then sunk to cut the vein at a small depth, allowing for a westerly dip. The enclosing rock, which within 20 feet of the surface is hardly to be distinguished from the vein, gradually changes below this point, and within a depth of 10 or 15 feet becomes a hard compact talcose schist, often containing fine garnets, and not unfrequently iron pyrites. In this schist, at a small depth, are a multitude of quartz threads, and farther down these threads come together, forming a distinct quartz band, often enclosing portions of the schist. The gold disseminated indifferently near the surface, amongst the quartz, rotten schists and enclosing walls, gradually collects together into threads, usually ranging with the schistose portions within the quartz band. The walls are very distinctly marked, and easily separated, and are found to be no longer auriferous, while the quartz, of which the thickness amounts to 10 feet at a depth of about 100 feet from the surface, seems to increase continually in value.

The facts established with regard to the auriferous accumulations in this and others of the gold mines of Virginia, have a bearing not only on the practice of gold mining, but also on the general theory of metallic deposits. For the practice of gold mining in any systematic way, it is clearly important that the geology of the subject should be known, for there is hardly any department of mining in which the usual mode of estimating value, finding the yield of a sample by panning or

assay, is more deceptive. As indicators of gold, sulphuret of iron, and quartz, have been long known to possess singular value. Two or three kinds of slate or talcose schist, and a peculiar form of chlorite, are also found to be favourable generally. Here also, as elsewhere, garnets are remarkably constant; and some other conditions, such as the vicinity of chloritic and hornblendic rocks, and a peculiar state of the quartz, are worthy of notice. With regard to the theory of metalliferous deposits, the results are, I think, not less important. We have here one of the most extensive gold regions at present known, reaching from Georgia into Canada, and including in the part that I have examined two belts of auriferous rocks separated by syenite. The gold occurs in the rock beyond all question; and although occasionally to be obtained from placers or diggings, where it has been transported by water, this is an exception to the usual condition in this part of the country. The rock within 20 or 30 feet of the surface is in a state singularly different from that presented at the depth of 40 feet and more, and this difference does not admit of being explained by any ordinary or extraordinary kind of decomposition. The enclosing slates and schists are indeed rotten and disintegrated, the quartz broken and weathered, the iron highly oxidized, and the whole band or vein readily reduced to mud. This, too, is especially the case within a small depth from the surface. But decomposition will hardly account for a change in thick, well-defined quartz bands, to small but distinct threads, from an inch or two to a foot thick, perfectly detached from each other, and imbedded in innumerable thin flakes of coloured schists. It is another point of importance, that the appearance presented by the quartz, when forming veins sufficiently well marked to pass current on a cursory observation, is not the condition found to prevail generally, when the whole system of rocks is examined.

There were perhaps originally a multitude of beds, consisting of such materials as are still accumulating every day upon the earth. These beds were altered more or less by chemical agency, but while some still retain clear marks of their mechanical origin, others have become so far crystalline that the new arrangement of particles obliterates the old. That the syenites, greenstones, and gneissic rocks, as well as the chloritic schists, hornblendic

schists, pale and blue slates, and other well-marked mechanical rocks, were once alternating aqueous deposits, there is no doubt in my mind; and I also believe that the gold as well as the iron was originally disseminated through the whole, and has been since re-arranged and collected into certain portions, whether veins or bands, by a process of segregation, which has also changed siliceous sands into the condition of alternating quartz bands. The gold in this case is probably of Palæozoic age; for although no fossils have been found in the district, the structure of the country appears to show that the schists are of that period. But the segregation of the gold may have been a much more modern process.

There is yet another point to be noticed before quitting this subject. It appeared to me that all the phenomena I was enabled to investigate throughout the district point to slow and gradual change, without exceptional periods of sudden and violent outbursts of any kind, and even the elevation of the Alleghanies, and the accompanying upheaval of the eastern part of the North American continent, must I think have been exceedingly gradual. However opposed this view may seem to the usual opinion, and to that advocated by Professor Rogers, whose investigations have been minute, and worthy of all praise, I must still venture to uphold the probability of no great or paroxysmal movement having affected this large district, nor can I at all subscribe to his views of a vast subterranean sea of melted rock, by the waves of which the upper and hard strata were bent and contorted. The structure of the rocks forming the Alleghanies, and the mode in which they are situated in reference to each other, is a matter on which much discussion has arisen, and which still remains unsettled; and it is not within the scope of my present plan either to repeat what has been written on this subject, or raise discussion on a theoretical point.

The gold-bearing rocks exist, as I have described them, in belts of irregular breadth, and at very different distances from the central axis, not only through Virginia, but very far to the north-east and south. In South Carolina they have been described by Mr. Tuomey*, and have been long worked. In

* Report on the Geology of South Carolina, by Mr. Tuomey. 1848. See chap. iii. p. 85 *et seq.* See also Taylor and Clemson's Report on Virginia, in the first volume of the Trans. Geol. Soc. of Pennsylvania.

Georgia and North Carolina they are also worked, and generally under very similar conditions, and to a considerable depth. Treated in the ordinary way, and by processes subject to heavy loss by peculation, the extraction of the gold is rarely profitable to the companies that undertake this work; but the average yield appears sufficient to repay all charges, and leave a very sufficient margin of profit, were not the resulting metal so valuable, and so easily secreted and stolen.

Analysis of Water from White Sulphur Springs.

(See page 279.)

From 100 cubic inches (about $3\frac{1}{2}$ pints) of this water taken by Prof. W. B. Rogers, of the University of Virginia, 65·54 grains of solid matter were obtained by evaporation at 212° F. The following is the result of an analysis of this residuum:—

Sulphate of lime	31·680 grains.
—— magnesia	8·241
—— soda	4·050
Carbonate of lime	1·530
—— magnesia	0·506
Chloride of magnesium	0·071
—— calcium	0·010
—— sodium	0·226
Protosulphate of iron	0·069
Sulphate of alumina	0·012
Earthy phosphates	trace.
Nitrogenized organic matter, with sulphur, about	5·000
Iodine, with sodium or magnesium ...	trace.

There were also obtained the following gases from the same quantity, 100 cubic inches of the water:—

Sulphuretted hydrogen ...	0·66 to 1·30 cub. inches.
Nitrogen	1·88
Oxygen	0·19
Carbonic acid	3·67

CHAPTER THE FOURTH.

SLAVERY AS AN ECONOMICAL QUESTION.

THE substance of the following remarks was communicated, almost as here given, in three letters published in the 'Times' newspaper, immediately after my return from America. I reproduce them here, in the hope that the subject may attract attention. As it was a part of my business to observe and inquire into the condition of the labouring population in some of the slave States, I early came to the conclusion that, since after all that has been said and written on the subject, there were many of my fellow-countrymen whose knowledge of slave life does not extend beyond 'Uncle Tom,' it might not only be useful to them, but even have a beneficial influence on the great question of emancipation, if I were honestly to put forward my views, and endeavour also to remove, as far as lay in my power, some of the evil and bitter feeling existing on the subject in America.

I make no apology for submitting these remarks, as they must be taken for what they are worth, without reference to the amount of actual experience and observation I may have had personally in the matter. I have endeavoured to approach the subject with temper, and with due consideration for all those concerned; and I am satisfied that in this way only can any real good be looked for.

I must begin by stating my firm conviction that not only is the system of slavery indefensible on the broad principles of natural justice and morality, but that it is uneconomical and highly impolitic as a source of supply of human labour—checking improvement, encouraging recklessness on the part of the labourer, and combining the worst features of our former and present poor-law system with none of the redeeming qualities of either, except the finding sustenance and shelter for the sick, the homeless, and the helpless. I consider that both on civil and religious grounds it should cease to exist in civilized

countries; and the only question that arises is that of how and when the existing evil can be best remedied.

But having said so much as a matter of opinion, let us look at the facts. Slavery has existed as a system for about three centuries in various parts of the country that now forms the United States of America, having been introduced shortly after the first settlement of the country, continued, and even enforced, by local governments, although contrary to the principle of English law, and at length only abandoned by degrees in the Northern States. Since the commencement of 1808, the importation of slaves from abroad has, however, been strictly prohibited, and thus, with few exceptions, the whole of the existing population may be said to have known no other condition than that of servitude from their earliest recollection, while a very large proportion have been born and bred altogether without an idea of practical liberty.

No stranger can visit a slave-holding State without being struck by the general adaptation of the coloured people to their condition. With few exceptions, it is quite clear at a glance, and becomes more so on further investigation, that in all essential points they are children, and, like children, totally unfit to take the management of their own affairs, and advance their own interests. Nor can it be otherwise while things remain in their present state.

In domestic service, where they are most favourably circumstanced, and really associate on terms which to an Englishman appear to involve much more equality than is pleasant, they are allowed to have their own way to a degree utterly inconsistent with good management. In small country families all the arrangements of meals and other matters depend on their pleasure. If Aunty, the cook, wants to go out on Sunday to a dipping service or preaching some ten miles off—no uncommon event—the family must either breakfast at six or not at all. If Pompey has been out on Saturday night rather later than usual and has had an extra half-dollar for whiskey, the boots and shoes, and often the horses, must remain unattended to; and as there is no punishment short of flogging, and few masters resort to that for any but serious cases, the offence is overlooked and soon becomes a habit. Speaking seriously to servants of this class is about as efficacious as it would be to scold a steam-

engine. They have few moral responsibilities; their sense of right and wrong is very low; they are perfect creatures of impulse; and, like young children, they are generally credulous, and tolerably obedient; but the smallest temptation to do wrong is quite irresistible, and they repeat offences and follies over and over again, learning nothing by experience.

If it is painful thus to speak of a great family of the human race, it is no less necessary that their true state should be understood before their condition can be improved. I wish to impress upon my readers, that this very condition, which to a great extent is the result of the system of slavery, is also the cause why the system could not be put an end to suddenly without breaking up the foundations of society, and throwing upon their own resources a vast population (upwards of 3,000,000) totally without such education and experience as could enable them to act prudently for themselves. Thus, nearly all those runaway slaves who escape into Canada—and the number is not inconsiderable—are found to be idle, useless, and unimproving in every sense of the word. Their idea of liberty is an escape from labour, and the indulgence of a mere animal existence with as little effort as possible. They are bad servants and bad citizens, and rarely rise above the very lowest position in the social scale. This is matter perfectly notorious; and we must not be surprised if, before long, the people of Canada refuse to admit a population which has no value, and frequently becomes a drag on the resources of the country*.

The history of the freed coloured races in the United States affords instructive lessons as to the probable result of emancipation, although very gradually brought about under the most favourable circumstances. Thus, before the commencement of the present century, either actual or prospective emancipation had been secured in Vermont, Massachusetts (including Maine), Pennsylvania, New Hampshire, Rhode Island, Connecticut, and New York; and, in 1804, New Jersey was added to this list. Ohio, with several of the Western States, is now also free. It

* I need hardly say, that a number of special exceptions, such as might easily be found, will not affect the value of statistical facts in reference to this point. No one will deny that coloured people can be found gifted with considerable talents, and possessed of high moral susceptibilities, but the argument must rest on classes of facts, not on isolated cases.

appears, from authentic documents, that the total coloured population of the New England States (the first seven of the above list, including Pennsylvania), was, in 1820, a little less than 21,000; the white inhabitants then numbering 1,639,128. The following table shows, in a very striking manner, the statistics of the free coloured population in certain States of North America at successive periods, and illustrates the total absence of any natural tendency of such a people to adapt themselves to circumstances:—

	1850.	1840.	1830.	1820.
Maine	1,313	1,355	1,117	929
New Hampshire	477	587	607	783
Vermont ...	710	730	831	918
Massachusetts...	8,773	8,638	7,049	6,740
Rhode Island ...	3,544	3,238	3,588	3,502
Connecticut ...	7,416	8,105	8,072	8,069
	22,233	22,653	21,264	20,941

That, in a district where the total population has increased, as in New England, as much as 65 per cent. within thirty years, a particular part of the population, with no perceptible migration, should increase little more than 6 per cent., and latterly actually diminish, while in other parts of the same country, where this same kind of population, too, is apparently placed in a less favourable state, they should increase rapidly*, is a fact so startling, and one that speaks so strongly as to the condition of the people in the Northern States, and their total want of adaptability to the circumstances in which they are placed, that no argument can add to the effect it must produce on every one who looks at the probable future with regard to the Negro race in America.

Nor must it be imagined that any amalgamation that may be going on alters the conclusions. It is notorious, that any stain

* The general increase of the slave population between 1820 and 1850 was more than 100 per cent., and the increase in the three States longest settled and least affected by change (Virginia, North Carolina, and Kentucky) was nearly 20 per cent., in spite of losses by runaways and numerous emancipations, to which, indeed, these States are especially liable.

whatever of Negro blood at once places the victim into the coloured class; so that every amalgamation has a tendency to swell that list. And now, it may well be asked, what is the condition of this people—freemen among the free, but not, like their fellow-citizens, obeying the natural law "to increase and multiply?" The reply is, that, with extremely few exceptions, they obtain only the very lowest employments, and those least requiring continued active exertion; and that though they sometimes accumulate money, they rarely raise themselves by its means into any higher position, but remain as small barbers, shoeblacks, waiters at hotels, or in what other capacity they may have been first employed. The exceptions, it may be said, leave the country, not finding there the sympathy that would enable them to take higher employments, and thus elevate themselves effectually; and, no doubt, this may be the case. But, as it is quite certain that few of them go to Canada, we ourselves in England are the best judges of how large, or rather how small, the number must be, since the question of language would of necessity decide the direction of their final emigration.

In point of fact, the physical peculiarities and natural *habitat* of the negro, and those peculiar qualities which characterise him, are such, as not to form a useful amalgamation with the Anglo-Saxon race in North America, even when allowed such fair play as seems possible. It is to all appearance physically impossible that the two should be on a true level; and, as is universal in such cases, the stronger must drive out the weaker. Under these circumstances, and regarding both the moral and physical unfitness of the coloured people to mix on terms of real equality with the present white population of the United States, I venture to suggest to those who would really befriend the cause of humanity, that they withhold for a time the conclusion that a sudden hypothetical freedom, effected by an act of legislature, would, even if it were possible, be a benefit to those they desire to assist.

I have thus endeavoured to show that, however, for the sake of humanity, one might desire and recommend the abolition of slavery in the United States of America, it would not be for the true interest either of the coloured race or the white population that such emancipation should be sudden, or should apply to men fully grown it may be, in years, but mere children in experience,

who have no practical ideas of liberty, and whose education has not fitted them for such a change in their social condition.

But no one should lose sight of the fact, that the present political and social condition of the United States really does not admit of immediate emancipation. There is, most unfortunately, a feeling of soreness and exasperation that has arisen with the abolitionist outcry, and still remains in great force, and there can hardly be a doubt that any attempt at legislative interference under such circumstances would be met by direct and active resistance. It is so manifestly to the advantage of the cause of political freedom and constitutional government throughout the world, that no separation of feeling and interests should take place between the Northern and Southern States of America, and such a result must so clearly perpetuate slavery in its worst forms in all those parts of the country where it now exists, that no wise man would risk such a result for the possibility of success in a war of words. Success in appearance would indeed be the worst failure in reality, and I would earnestly submit to all those who feel deeply on the subject of emancipation, to look well to the course they adopt, lest it should result in a long and systematic delay rather than in the advancement of the object they have at heart.

It may be imagined, that as lately the advocates of slavery have been more active than usual in the South, there is no probability of slave-owners altering their opinion and moving towards emancipation in the absence of pressure from without. I believe that such is not altogether the case. The history of abolition shows that at one period the inhabitants of Virginia were on the very point of getting rid of slavery, and that public feeling in several other States was rapidly leading to a similar result. There is really no reason why such a feeling should not return; but the way to induce it is rather to show the advantage of free labour and the absence of any of that supposed necessity for slavery so often assumed, than to attempt what can never be performed—namely, an immediate change in the habits of a large population not remarkable for a quick perception even of their own interests in any modifications of existing conditions, and much less inclined to movement than their energetic fellow-countrymen of the Northern States.

I am prepared, however, to argue that slave labour is at this

time both unnecessary and uneconomical, at least in the six Northern slave-holding States, Virginia, Maryland, the two Carolinas, Kentucky, and Tennessee, the total amount of whose slave population in 1850 was something more than a million and a half, being about equal to that of all the rest of the slave States together. I am not familiar with the conditions of labour in the warm, moist climates of the South, but I am perfectly satisfied that if the experiment were tried in the States above-mentioned, and were found successful, it would soon be followed in so many of the others, that slavery would, before long, be abolished altogether.

At the present time the sum paid for a coloured adult in good health and strength, but without special qualities*, is between 800 and 1000 dollars (say £160 to £200), and this may, I believe, be considered a fair average price. For this sum the right of property is acquired in a man, who must always be fed, and clothed, and kept in good health, whether his services are needed or not, and whether or not he is at all the sort of servant required; for in this, as in other dealings, few people can exchange except at a considerable loss; and thus, each slave acquired by purchase generally becomes a life charge to the estate of the purchaser. The nature of the charge is best ascertained by noticing the price at which such labour can be underlet by the owner, this amounting by the year to about 10 per cent. on the prime cost. The hirer of labour, in addition to the sum of $100 per annum, has also to find food, shelter, medicine when needed, and clothing; so that it is quite impossible to estimate the actual price paid for coloured labour at less than 2*s.* per working day. It may seem, at first sight, that, since free labour can only be obtained at about 3*s.* 6*d.* per day, and even at that price with difficulty, the slave must be cheaper; and on this fallacy is based the idea that slave labour is profitable. But there are other things to be considered than the price per day. There can be no direct competition between white and coloured labour where slavery exists, since the poor white labourer looks down on the black slave, who is often much the better off in reality, and refuses to work with

* Smiths, carpenters, masons, and others who have been taught a trade, and practise it successfully, are much more valuable.

him; while the black man regards with singular contempt any white person employed to labour at menial services. Thus the system of slavery tends to keep the white population of the poorer classes in the lowest, most ignorant, and most unimproving state, by the mere force of circumstances; preventing their advance by honest labour, and nursing the most debasing pride of race, without in the smallest degree elevating the negro or improving his methods of labour. The contrast between the families of small farmers in Virginia and those in the Northern States is extremely remarkable in this respect; and the absolute division of society into the rich and poor white people in the former, is quite as striking, and more injurious to both, than any lines of demarcation, however broad, that exist in England. I am satisfied that the doing away with this kind of class-interest, and the alteration of system in the cultivation of land, that must inevitably follow when slavery is abandoned, would soon result in the formation of a class of white agricultural labourers, at moderate wages, whose work would before long put quite a new value on the cultivated tracts, and bring back into use many others that are now unwisely neglected, after having once been foolishly exhausted.

But, in the next place, it must not be supposed that in paying slave labour at the rate of 2*s.* per day, and white men 3*s.* 6*d.*, the one is 75 per cent. dearer than the other. It is so in no sense; for, merely as labourers, free white men are worth 50 per cent. more than blacks, when they work steadily. Placed in their present false position, indeed, the former are difficult to manage, for they are too few to compete among each other, and when wanted, they are troublesome, and cannot be depended on. It is clear, however, from what has lately happened in Georgia, that this is not necessarily the case, when a sufficient demand for labour exists; for, in cotton factories that have been established there, coloured labour was first tried, and has been superseded with great advantage by white, there being always abundance of hands offering themselves. Nor must it be forgotten, that, in paying for a slave, you pay whether you can use his services or not—whether he is a good or bad workman—whether he is well or ill, young or old, adapted or not for the labour in question. The slave takes but little interest, beyond that of a child, in the progress of things, even if willing and intelligent; for he can-

not look to the example of those who from a similar humble commencement to his own have risen to wealth and distinction by the mere force of good conduct, intelligence, patience, and perseverance. By the exercise of superior talents, intelligence, and industry, he may, indeed, become more valuable to his master; but, for that very reason, he is only placed further off than ever from independence.

It cannot be, therefore, that the Negro will bear comparison with the Anglo-Saxon, even when much higher wages are paid to the latter,—since he labours for his own bread, and for the support of his own family,—his own success being in a great measure bound up in that of his employers. There can be no question, that, wherever white labour can be had and applied, it is in all respects far superior to coloured; and no one who is at all aware of the climate and condition of Virginia, and the other States above alluded to, can doubt that every kind of work, whether agricultural or manufacturing, might, with perfect facility, be performed there by white men, if there were no Negro population.

The amount of capital involved in the possession of slaves in Virginia alone cannot be estimated at less than fifty millions sterling; and this dead-weight, for so it is, seems to produce an effect equivalent to that of a mortgage on a large landed property, rather than serve as a means for securing a certain amount of labour. It is also painful to observe what a drag on the middle classes, having moderate resources, a few slaves invariably prove. Both humanity and the force of habit interfere, as a general rule, to check the separation of parents from children, and husbands from wives; and numerous families of small farmers struggle on with their unwieldy train of Negro men, women, and children, many more than can do any good in the house, but not enough, or well enough directed, to be useful in the field; suffering an increasing but hopeless evil, unable to obtain white servants, and equally unable to do without some help. Thus are these people the unhappy victims of a system which is destroying them, but which yet they are anxious to retain, believing that what has a marketable value must be valuable property, and not knowing that it would be far cheaper for them, and better, to hire attendance and assistance when they actually wanted it, than have forced on them a useless and

costly superfluity, under whatever name it comes. Emancipation would, indeed, be an infinite advantage to this class, whenever and however it might be brought about.

One point is worthy of consideration here, with reference to the relative increase of population in particular States. Thus, in Virginia, the actual number of slaves has increased only 47,375, or $11\frac{1}{7}$th per cent., between 1820 and 1850; while, during that time, the white population has increased no less than 308,907, or upwards of 48 per cent. Such is the case, also, in all those States above referred to, which have been long settled. The natural consequence of this is, that white labourers are now comparatively more plentiful, and have to seek employment, so that occasionally some competition has arisen. This is especially seen where manufactories are established, and a steady demand secured for a large number of hands. The slaves, however, in all these cases, have merely been carried westward, to the newly-settled territories, and thus spread over a larger surface, as the population returns do not show a very different rate of advance to exist between the white and coloured people in the slave-holding States generally,—the increase of each for the last ten years being nearly $27\frac{1}{2}$ per cent.

The results of the system of slavery are perhaps best seen by contrasting the present state and past progress of the slave-holding and free States, especially those nearly in contact, and under similar climatic conditions. Thus, if we compare the whole population of Virginia with that of Pennsylvania (with which it is most fairly compared, although Ohio approaches nearest in magnitude), we find that in 1790 Virginia had about 748,000 and Pennsylvania 434,000 inhabitants; and while, by the last census, the former State is found not to have doubled its population in the 60 years that had elapsed, the latter during the same time has increased to nearly six times its former amount. Within the last 20 years Ohio has more than doubled, and Pennsylvania has increased more than 34 per cent., but Virginia only about 17 per cent. So, again, Kentucky has taken 35 years to double its population, Tennessee about 27 years, both North and South Carolina more than 50 years, and Georgia more than 25. These are all old slave States, and their populations, taken together, have required 40 years to double; while

the general population of the United States has lately doubled in about 20 years, and has much more than trebled within 40.

But there are other modes of estimating progress. In Virginia, which has certainly large capital, numerous rich landowners, a delightful climate, and an unusual extent of extremely fertile lands, it is not a little startling to find, in travelling across the country, that vast tracts are now under timber which have once been cleared and cultivated. Agriculture is carelessly conducted, and only the rich alluvial bottoms seem at all regarded. The towns have a forsaken and desolate air. The people seem without enterprise, and one hears more complaints against existing railroads than wishes for additional communication; so that it need excite no surprise when we find that of 12,800 miles of railway now finished in the United States, little more than one-fourth part runs through the 640,000 square miles of slave-holding territory, the remaining three-fourths being in about 360,000 square miles of free land.

Once more. In Pennsylvania there exists a wide extent of country abounding with coal, almost entirely, however, anthracitic, and with few natural advantages for bringing it to market. In spite of great difficulties, and large outlay required for canal and railroad, the annual production of the coal had reached last year to nearly five millions of tons, the quantity doubling in five years. In Virginia there also exist tracts of coal-land not less valuable, the coal here being bituminous. The eastern coal-field, near Richmond, has been developed very slightly; and the western, which is perfectly capable of supplying the whole western market at prices lower than are paid in England, has hitherto been scarcely touched. Yet this coal is workable without the smallest mechanical difficulty, cropping out on the sides of hills close to navigable rivers; and although these rivers are covered by steam-boats, most of them burn wood instead of coal, owing to the non-development of the resources of the district, and the absence of any continuous supply of mineral fuel.

Ever since the first discovery of America, Virginia, North and South Carolina, and Georgia have been well-known as yielding gold, and enough of the precious metal has been found to justify the establishment of a mint in that part of the States. Few spots could, however, be pointed out at this day where any

operations have been carried on with the smallest regard to economy, while generally the washings at the surface have not even suggested the possibility of rich stores of metal at a small depth. I heard of a case in which four negroes were employed baling out water from a pit 30 feet deep, while two others raised the ore. It is still more extraordinary to have to add, that the resulting sands were found to pay a handsome profit by hand panning.

Am I not, then, justified in asserting that as a system, slavery involves a large and wasteful, because unnecessary, use of capital, invested in the purchase of untenable claims over human beings which give no real advantage to the possessor, while they interfere with the wholesome and necessary competition of labour and check all improvements in agriculture, and every kind of manufacturing enterprise? I think that this "dollar-and-cent" view of the case, however low it may seem, is, after all, the only way in which any practical result can be obtained. I have also too great a respect for the hospitable and agreeable inhabitants of the slave States not to believe that they will advocate a change, if they can be satisfied that the institution which they have hitherto advocated as necessary for the proper development of their resources, can with advantage be dispensed with. I maintain, however, that it is a frightful incubus that has checked their industry, prevented them from taking advantage of their vast natural resources of all kinds, kept back their population, starved their infant manufactures, and, in a word, has destroyed in them that spirit of enterprise, which, if encouraged, might have placed Virginia in the position of New York, and carried much of the trade of Europe in a different channel from that it has now taken for itself in America.

But if it is desirable, for the best interests of the slave-owner, and the development of the resources of the country, that slavery in America should cease, and if at the same time it is true that the coloured people are not prepared for this change, and need some education to be fitted for it, we naturally turn to consider how emancipation can be contrived to secure the greatest good to all parties with the smallest admixture of danger or wrong.

When any person, trusting to the protection which every independent State owes to its members, invests his capital in merchandise considered at the time legal, he clearly has an in-

alienable right to the continuance of such protection, so far as abstract possession and use are concerned. It is, however, equally clear, that, if the State think fit to enact laws which shall incidentally affect the value of his property, he has no right to complain, but must submit to the sacrifice for the assumed benefit of society. Thus, in the case of slavery, it would be difficult to imagine any reasonable ground for declaring immediate emancipation without giving equivalent compensation; but this need not apply to children not yet born, or to slaves brought into the State from some foreign country, or different government. Now, the question of compensation cannot be entertained, since the lowest amount that could be named as the present value of all the slaves in the United States would exceed £150,000,000 sterling, and it is idle to waste time and argument in proving that this sacrifice could not be made, under existing circumstances, in America.

That all children born after a certain date shall be free at a fixed age; that meanwhile husbands should not be separated from wives when belonging to the same property originally, or children of very tender age torn from their mothers' arms; and that every coloured person brought into the State by a master, except for temporary purposes, should be liberated; these are measures suggested by policy as well as humanity, and such as, if temperately urged, might possibly be obtained. In this way, ultimate emancipation would be secured, at a period probably quite as soon as the slave population would be in a condition to take advantage of it. But this is by no means all that the United States, as a government, owes to these people. It is clear that, whether by public institutions or otherwise, some kind of education should be provided, to enable the children thus destined for freedom to benefit by the change, although the mere fact that they were to become free would of itself exercise a beneficial influence on the conduct and development of the best among them.

It may occur to some of those interested, and to many looking at the subject for the first time, or without due consideration, that the slaveholder would, in case of emancipation, be still a loser to the extent of his prospective interest in the property he holds, and has, therefore, a claim on the Government. But, independently of the fact that a man can never, with reason or

propriety, be regarded as having a beneficial interest in unborn slaves, it is really not the case that from a change so long anticipated any real loss could occur. This is clear from the experience of the Northern States, since, in the State of New York, where 10,000 slaves became free on one day, in 1827, it is not known that a single slave had been sold into another State in anticipation of the event, nor did there seem much more business doing in the slave-market elsewhere than was usual. It is also well known that no evil consequence was recognized as resulting from emancipation.

I have already stated that the free Negro does not generally make much effort to rise in society, nor are there in America many facilities for his doing so. There is, therefore, no great probability that the position of the class would be greatly altered by a change to freedom, or that the farm labourer would endeavour to obtain land for cultivation; but there would unquestionably be an immediate immigration of white labourers, displacing, for the most part, the coloured ones, and gradually increasing the value of land, and the extent of land under cultivation. Perhaps after a time the large plantations would be divided, and numerous settlers come in at a trifling charge to reclaim old and neglected portions of them. Manufacturing towns would spring up on the banks of navigable rivers and near fuel; railroads would be commenced to connect distant points, and the mineral as well as agricultural resources of the country would for the first time be made available.

Meanwhile what would become of the emancipated coloured people? If they were to remain in the country, it is to be feared that they would for the most part gradually pass into the condition of hewers of wood and drawers of water, even although nominally free. It is, I think, perfectly clear that no true equality can exist between races differing as much as do the Negro and the Anglo-Saxon. It is equally clear, that no valid and useful amalgamation of the races is likely to take place. With regard to these points, the experience of sixty years in North America, even if not sufficient to afford proof, is at least and unmistakeably all in the same direction, tending to show that the coloured race disappears, not by absorption into the white, but by a process of absolute extinction.

It is also the case that the presence of a large Negro population

could not but complicate the problem of labour, were the present slave States to abandon the system abruptly. No white man will willingly engage himself to do work commonly performed by blacks; and as this has always been felt to be the great difficulty in any partial emancipation, so it would doubtless immediately and greatly interfere with the proper working of any system that should liberate the slaves without long notice. To remedy the great evil felt on this account, a society was established, a quarter of a century ago, for the deportation of such free Negroes as might desire, to a colony established in Africa. This most reasonable and desirable attempt, if successful on a large scale, would afford to the black man a home in a climate more resembling that adapted to his constitutional peculiarities than any obtainable in America. Here he might employ with every advantage to himself and his coloured fellow-colonists, the education he had acquired, and the talents he possessed, and hence a nucleus might be formed which would afford a means of usefulness, not only by relieving America of a difficulty, but by placing civilization within the reach of various African tribes who are peculiarly difficult to deal with in any other way.

The labours of the Colonization Society did not for a long time meet with the approval of the Abolitionist party. It was not enough that the slave should be set free, and assisted on his way to a spot where alone his freedom would be really complete, but he must be placed on a shadowy and ideal equality with the white man in a country certainly not suited to his physical condition, and, as far as can be learned from statistical facts, destined to be the grave of his race, if retained there. Lately, however, the advocates of colonization, and those who regard Liberia as the best future home of the freed Negro, have been more favourably considered even by the Ultra-Abolitionist party; and the advantages of the system appear, when honestly looked into, both real and considerable. The evidence of good being done is, indeed, very satisfactory, and sufficient to justify an expectation of far wider and more extensive results than could have been anticipated,—such results having reference chiefly to the effect produced on the native tribes of the interior.

A sound though simple education, adapted to the probable requirements of the people, an acquaintance with the most ne-

cessary arts and contrivances of civilized life, established habits of industry, and the inculcation, as far as possible, of a spirit of progress—these would be the best treasures that could accompany the African returning to the home of his ancestors from a long sojourn in a distant country. These, and these only, could he keep and use effectually; and for ensuring these, the efforts of every friend of the coloured races should be incessant and urgent. With them he may found a republic or an empire in Western tropical Africa, which, by encouraging commercial enterprise, might soon occupy an important position among nations; and then, bringing good out of evil, the institution of slavery might be the means of elevating the vast population of an almost unknown continent to rival their former masters, and render available those riches, the search for which has hitherto terminated invariably in fever and death. It would be a worthy and a noble revenge of the American people on the early colonial government of their country, who often encouraged and defended the slave trade against the wish of the settlers, if these latter, or their descendants, should now carry back to the African shores a population of free and intelligent coloured emigrants, who have learned what civilization and freedom can do, who have had experience of the justice that public opinion can enforce when it has reason on its side, and who, having seen something of the evils and folly of enforced labour, may be expected to form a living barrier against the debasing and infamous trade in human flesh, which, in spite of every effort, will go on so long as there are savage tribes to fight and steal, and wicked governments to encourage any system, however terrible, that promises present gain.

It would need but little time and investigation to illustrate clearly the fact that slavery as a system in the United States is a failure, but the details necessary for this would lead me too far, and occupy too much space. The evidence of this fact would include, in addition to the population returns already referred to, contrasts so strange between slave and free States in point of actual progress, and differences so considerable between the condition of the great majority of the white races under the one system and the other, even where there are no differences of climate, fertility, or other natural advantages to account for the discrepancy, that I feel convinced a mere state-

ment of them, if well and calmly set forth, without invective and without prejudice, would have great weight in determining the slave question. If, too, the effort were made, and the question of gradual emancipation fairly tried in the Northern slave States, before commencing in the Southern, the only grave practical difficulties that present themselves, and which have reference to a supposed impossibility of employing white labour in certain kinds of cultivation, would be met gradually and without danger.

In conclusion, I would earnestly impress on my fellow-countrymen, that their righteous indignation and horror at slavery in America, and their strong appeals on the score of justice and humanity, however reasonable and just they may now seem on this side of the Atlantic, do not produce all the effect that is expected, on the other side; nor is that effect quite of the same kind as we hope. England introduced slavery into her colonies, and supported the system for a long time quite as tenaciously as America has done since*. If we ourselves, placed at a distance from the scene of action, and able to survey coolly both the system and its results, in which most of us were not personally interested, have only been able by great efforts, at enormous cost, and after a long time, to eradicate the hateful evil of slavery in our own West Indian possessions, we ought to have

* It is necessary, at the present day, that Englishmen should recall to mind the acts of their ancestors in this matter. In the year 1848, the Hon. Horace Mann, speaking in Congress on the subject of slavery, said, with perfect truth,—"The New England colonies, New Jersey, Pennsylvania, and Virginia, presented to the throne the most humble and suppliant petitions, praying for the abolition of the trade. The Colonial Legislatures passed laws against it. *But their petitions were spurned from the throne. Their laws were vetoed by their governors.*" And yet it appears that, in 1772, the Court of King's Bench, Lord Mansfield presiding, decided in respect to England, that there neither then was, nor ever had been, any legal slavery in England. In the face of these facts, it is difficult to justify the feelings of indignation and astonishment often assumed in reference to modern slavery in America. The crime of slavery may be great; but, if asked for the original criminal, the colonist of the United States cannot but look to the history of his country, where he is reminded that, for a long time, although the law repudiated the existence of the system on English ground, the Government actually not only encouraged its introduction, and justified its enormities in the colonies, but actively interfered to prevent its extinction.

some feelings of sympathy and kindness, as well as pity and horror, for those who only defend now what we practised and defended a few years ago; and we should endeavour rather to prove to our neighbours the advantage of our own changes, than taunt them with adhering a little longer than ourselves to existing arrangements. In point of fact, no good can be done on this question so long as feeling and passion take the place of reason and policy, and whilst those who act according to their knowledge, and on the experience of their predecessors, are accused of being guilty of crimes from which they would shrink with no less horror than their accusers. It is the system that requires to be altered; but we attack those who practise it. The result is, that the system remains, and those attacked put themselves on their defence. Were we to treat the slave-holders as honest, well-intentioned country gentlemen, not unwilling to improve their property in any way open to them, giving them credit for as much humanity and kindness as we ourselves lay claim to, we should only do justice to them as a class, and perhaps might prepare them to listen to any arguments we could adduce in favour of a change in their system of labour.

INDEX.

Aar valley, near Soleure, 66.
Abolition of slavery, formerly nearly accomplished in Virginia, 298; only to be effected gradually, 305.
Adra, account of, 158.
Africa, first approach to, 193.
Agde, basaltic column at, 38.
Agriculture, imperfect state of, in the Slave states of America, 304.
Alameda of Valencia, account of, 114.
Alfaques (Delta of the Ebro), account of, 102.
Algeria, costume of the Arabs of, 193, 195, 209; prospects of mining in, 236.
Algiers, account of, 194.
Alhambra, account of, 142.
Alhamilla, Sierra de, 148, 162.
Alleghany ridge of the Appalachian chain, 280.
Alleghany river, the chief feeder of the Ohio, 255.
Allelah (Oued), (Algeria), mining concession of, 233.
Almeria, river and town of, 161, 163.
Alpujarras, valley of, 145.
Amphitheatre of Nîsmes, 32.
Amposta, the Ebro at, 101; structure of the country near, 106.
Amusements of the Sardinians, 177.
Analysis of Pichiguet ores (Aveyron), 21; of Pyrmont waters, 80; of White Sulphur springs, 293.
Ancenis, price of coal at, 5; section of the coal-field, 7.
Andalusia, general account of, 163.
Anthracite, formation of, 279; found in Sardinia, 181.
Antiquities of Arles, Nîsmes, &c., 31; of Sardinia, 174, 178; of Cherchel, 200.
Appalachian chain, first view of, from the west, 276; section across, 282.
Aqueducts, Roman, at Nîsmes, 35; in Algeria, 202.
Aqueous action, singular example of, near Tenez, 230.
Arabs of Algeria, costume of, 193, 209.
Aranjuez, and railroad thence from Madrid, 140.
Arbus (Sardinia), mines near, 185.
Architecture, Moorish, at Algiers, 197.
Arcuenta Point (Sardinia), basalt of, 187.
Arles, beauty of its inhabitants, 31.
Armstrong's Creek (Western Virginia), curious irregularity of the coal in, 274.
Artesian springs in Algeria, 218.
Astor house, New York, account of, 243.
Atlas, Lesser, picturesque form of the chain, 194; exposed to earthquake action, 207; structure of, near Mouzäia, 222; near Tenez, 226, *et seq.*
Aubin coal-field (Central France), account of, 12.
Auriferous pyrites, notice of, 288.
Auriferous tract of Eastern Virginia, 283.
Aveyron, department of, its mineral resources, 10; copper and lead ores of, 20; the limestone plateau, 26.
Azulejos (tiles so called, used in Valencia), 111.

Bailen (Andalusia), scenery near, 140.
Barcelona, account of, 94.
Barcelona to Tarragona, account of the country, 103.
Barèges (Pyrenees), costumes of peasants there, 42.

Barranca, nature of these dry river-courses as seen in Spain, 103, 155.
Basalt at Agde, South of France, 38; at Oristano (Sardinia), 187; near Tenez, 223.
Basaltic rock on the coast of Algeria, 226.
Basins, coal, of Ancenis, 7; of Aubin, 12; of Rodez, 16; of the Ohio, 262.
Basque provinces, general character of, 135.
Bayonne, account of, 39.
Becher, Mr. Henry, a sermon by, 249.
Beggars of Madrid and other towns in Spain, 115, 119.
Bellegarde, fortress of (between Spain and France), 86.
Berja (Andalusia), description of, 156.
Biarritz, near Bayonne, caverns of, 40.
Bienne, Switzerland, granite boulders near, 67.
Birmandreis, village of (Algeria), 215.
Bituminous coal of Ancenis, 7; of Aubin, 12; of Rodez, 16; of the Kanawha, 265.
Blidah (Algeria), account of, 206; slates and slabs near, 220; copper near, 226.
Blue Ridge (Appalachian chain), account of, 280.
Boghar (Algeria), cretaceous rocks of, 222.
Boisse, M., his account of the Aveyron mining district, 25.
Bonomi, Mr., his translation of an Arabic pass, 240.
Booker (Garnett and Mosely) gold mines, account of, 288.
Botanic garden or nursery at Algiers, notice of, 199.
Boukendack, copper mines of (Algeria), 234.
Boulon, the last French town before entering Spain from Perpignan, 86.
Bourkika (Algeria), wells at, 218.
Brest, coal required at, 5.
Bricks at New York, 246.
Brine springs of the Kanawha, 257.
Brittany, coal-field of Ancenis in, 3.
Buckingham mines (E. Virginia), account of, 287.
Building material in New York, 245.
Bull-fight at Madrid, 127; at Tortosa, 107.
Burgos and its cathedral, 134.
Byrse, picturesque valley of, 64.
Cabanou, Le, veins at, near Tenez, 233.
Cactuses, gigantic, near Tenez, 204.
Cadayrac (Aveyron), calcareous iron ores of, 19.
Cagliari (island of Sardinia), entrance to, 170; account of, 174.
Calcareous rocks (metalliferous) of Sardinia, 182. *See* also Limestone.
Campidano of Sardinia, account of, 181.
Canal of the Erdre and Loire, 9.
Canal du Midi, notice of, 38.
Canals in the valley of the Ebro, 98.
Canigou (one of the Pyrenean peaks), view of, from Boulon, 86.
Cannel coal of the Kanawha, 264.
Capital involved in American slave properties, 302.
Capital required for coal workings near Nantes, 5.
Capraia, its similarity with Elba in respect to iron ores, 168.
Carbonic acid gas, large quantity of, in the Pyrmont waters, 76.
Carolina, South, Mr. Tuomey's report on the geology of, 292.
Castile and La Mancha, roads across, 140.
Catalonia, costumes of, 87, 94.
Cathedral of Barcelona, 95; of Tarragona, 104; of Burgos, 134.
Caverns in the limestone of Roquefort, cheese-cellars made in, 29.
Cement stones in Algeria, 237; in the Kanawha coal-field, 262.
Central France, mineral wealth of, 10; metalliferous districts of, 19.
Central plateau of Spain, 132.
Chamærops humilis, its abundance in the Metidja plains, 218.
Charlestown (Kanawha), account of, 256.
Chaux de Fonds (Jura), account of, 56.
Cheese of Roquefort, account of the manufacture of, 30.
Cheliff, valley of (Algeria), 214.
Cherchel (Algeria), account of, 200.
Chiffa, gorge of the (Algeria), 207; village of, 220.
Churches and cathedral of Valencia, 114.
Cid, the city of the, Valencia so called, 111.
Cincinnati, demand for coal at, 268.
Clay (potter's and fire) and ironstone of the Kanawha valley, 273.
Coal and iron of Aveyron, 11.

Coal, qualities of, from various localities, 4, 15, 17, 253.
Coal-field of Ancenis, near Nantes, 3; of Aubin and Decazeville, 12; of Rodez, 16; near Barcelona (Catalonia), 93; the island of Sardinia, 190; of the Western States of North America, 252.
Coal lands near Pittsburg, value of, 253, 271.
Coalport (on the Ohio), coal shipped there, 256.
Coal river, a tributary of the Kanawha, 260; working of cannel coal at, 265.
Coal-working, mode adopted in the mines of Aubin, 15; near Pittsburg, 252.
Coast scenery of Sardinia, 168.
Col de Pertus, entrance to Spain by, 86.
Colonization of Algeria, 210.
Colonization Society (United States), usefulness of, 308.
Colour of the people on the east coast of Spain, 108.
Coloured population of the United States of America, statistical returns of, 297.
Columbia, a town on James river, oxide of iron at, 283.
Columns, ancient, at Cherchel, 200.
Competition in the Western American coal trade not probable for a long period, 271.
Conglomerates, remarkable, near Tenez, 230.
Conil, near Cadiz, sulphur from, 120.
Coponex, (Switzerland), account of, 51.
Copper, lead, and other ores of Aveyron, 19; of the island of Sardinia, 170.
Copper of Lake Superior used at Pittsburg, 251.
Copper mine of Boukendack (Algeria), 234; of Mouzäia, 224; of Oued Allelah, 233.
Copper works at Pittsburg, 251.
Cost of labour, for coal-working at Ancenis, 4; at Aubin, 15; at Rodez, 17; for copper mining at Tenez, 236; for coal-working at Pittsburg, 253; in the Kanawha valley, 261, 266; near Cincinnati, 271; for gold-mining in Eastern Virginia, 288.
Cost of transport of iron ore of Mondaluzac (Central France), 19.
Cost (relative) of slave and free labour in the slave States of N. America, 300, 301.
Costly dresses of Sardinian peasants, 176.
Costumes of Brittany at Nantes, 9; of French peasants near the Pyrenees, 42; of Catalonia, 87, 94; of fish-women of St. Jean de Luz, 138; of the island of Sardinia, 176; of the Valencians, 109; of Algiers, 193, 195, 209, 210.
Covington and Ohio railroad, Mr. Shaw's report on, 259.
Cretaceous rocks at Boghar, Algeria, 222.
Curiosity of the Americans well-grounded, 254.
Current of the Ebro, its rate, 102.

Dances of the Sardinian villagers, 177.
Dark colour of the Spaniards of the east coast, 108.
Degradation of soft shales near Tenez, 229.
Delaware and Hudson Canal Company, their coal trade, 270.
Delémont (Switzerland), account of country near, 65.
Delta of the Ebro, 102; of the Rhône, its advance, 38.
Demand for coal in Brittany, 4; in the Western States of America, 269.
Depth of coal workings in Brittany, 4; in Aveyron, 17.
Devonian shales of the Alleghanies, 277.
Dhamous, gorge of the (Algeria), 227.
Diligences, Spanish, account of, 90.
Direction of the lodes in the Aveyron mining district, 21; in Sardinia, 184, 188; in Algeria, 224, 232.
Disturbances of the coal-field near the Kanawha, 262.
Douro, valley of the, 133.
Drainage of the western lands of North America, 278.
Dressing ore, employment of native Arabs for that purpose near Tenez, 236.
Dryness of the atmosphere in Spain, 147.
Dünst-hohle, a gas cavern near Pyrmont, 76.

Earthquakes at Blidah, 207.
Ebro, valley of the, 98, 106.
Education desirable for the Slave before emancipation, 308.
El Fondon (Sierra de Gador), 161.
Elie de Beaumont, his theory of mineral veins referred to, 26.
Elk river, a tributary of the Kanawha, cannel coal of, 265.
Ellet, Mr., his memoir on the Mississippi valley, 258.
Emancipation of slaves not desirable without preparation, 305.
Encampments of the natives in Algeria, 209.
Equality of the negro with the white races of North America not real in a physical sense, 298.
Erdre, its river scenery, 8.
Erdre river, coal-fields near, 3.
Esparto, its importance in the south of Spain, 153.
Estimate of cost. *See* Cost of labour.
Externstein (near Pyrmont), rocks of, 78.

Failure of slavery as a system, 309.
Falls of the Kanawha, 258.
Faults, absence of, in the Kanawha coal-field, 266.
Ferrouka (Algeria), slabs worked at, 220.
Ferry-boats on the American rivers, 249.
Fertility of the soil of the island of Sardinia, 177; near Blidah (Algeria), 207.
Figeac (Aveyron), mineral field near, 21.
Figueiras (Catalonia), account of, 89.
Fire-clay of the Upper Kanawha, 273.
Flagstones of New York, 246.
Flats or barges used in the coal trade of the Ohio, cost of, 252.
Flint vein of the Kanawha, 264.
Flumini-maggiore (Sardinia), mines near, 185.
Fossu scuau, a mine near Arbus (Sardinia), 188.
Fossils of the Kanawha coal-field, 273.
Fournet, M., his account of the Aveyron district referred to, 25.
France, central, its mineral wealth, 10; limestone plateau, 27.
French coal-fields:—Brittany, 3; Aubin, 12; Rodez, 17.
French Geological Society, meeting held at Porrentruy, 58.
French habits prevalent in Algeria, 198.
Fruits of Algiers, 198.
Fuel, cost of, in Algiers, 225.

Gador, Sierra de, 148, 160.
Galena, abundance of, in Aveyron, 23; in the Sierra de Gador, 159; in the island of Sardinia, 182.
Galés (Aveyron), mines of, 23.
Gardens, Botanic, of Algiers, 199.
Garnet schists favourable for gold, 291.
Garnett and Mosely gold mines, 288.
Gas, inflammable, from brine springs in the Kanawha valley, 257.
Gas-making at Pittsburg, statistics of, 253.
Gascony and Languedoc, plains of, 31.
Gault, beds at Mouzäia contemporaneous with, 222.
Generalife, near the Alhambra, account of, 144.
Genna caru, mines of, in Sardinia, 184.
Geography, physical. *See* Physical Geography.
Geological structure. *See* Structure.
Geology of the neighbourhood of Porrentruy, 59; of the Eastern Pyrenees, 88; of the neighbourhood of Gerona, 93; of the Sierra Nevada of Spain, 146; of the island of Sardinia, 181; of Algeria, 220; of the Kanawha coal-field, 262; of the Alleghanies, 278; of the Virginian gold-field, 285.
German naturalists, meeting of, at Pyrmont, 73.
Gerona, account of, 91.
Glorietta of Valencia, account of, 114.
Gold of Aveyron district, Central France, 25.
Gold mines near James river, Eastern Virginia, 283 *et seq.*
Gossans of the Aveyron mineral district, 21.
Granada, Vega or plain of, 141; town of, 142.
Granite of Sardinia, 181; of Arbus, mines in, 187; near Algiers, 215; near New York, 247.

Gravels of the plains near the Pyrenees, 39.
Great Central railway of France, its importance and value, 10.
Great Kanawha. *See* Kanawha.
Greenbrier River valley, account of, 277.
Grey sulphuret of copper in Algeria, 225; 235.
Gritstone used at New York, 246.
Grottos, natural, of Roquefort, 29.
Ground-plan of a house in Sardinia, 175; of the interior of a mosque in Algiers, 197.
Gutturu vallu, a lead mine in Sardinia, 185.
Guyandotte river, coal of, 261.

Halloula lake, near Algiers, 217, 218.
Headlands, remarkable, near Tenez, 229.
Hilly district, or Sahel, of Algeria, 219.
'Horses' or interruptions of the coal seams in the Kanawha, 273.
Hospitality of the inhabitants of Sardinia, 171.
Houses in Sardinian villages, 175; of the native Arabs in Algeria, 208.
Howard's Creek, fine gorge of, 277, 279.
Hudson river, view of, from Brooklyn, 244.
Hydraulic limestone in and near the Kanawha coal-field, 262, 273.

Iglesias, account of mines near, 182.
Inns of Algiers, 208.
Interior of a mosque, plan of, 197.
Iron and coal of Central France, 10.
Iron ores of Aubin, 15; Mondaluzac, &c., 19; Capraia, 168; Algeria, 236; the Alleghanies, 262; Upper Kanawha, 273; New River (Western Virginia), 275.
Irrigation, its importance in Spain, 99.

James river and canal, 281.
Jaspery quartz of Le Minier (Aveyron), 23.
Jewesses of Algiers, their costume, 195.
Jougny, town of, 54.
Juanes, his pictures in Valencia, 131.
Julia Cæsarea, the modern Cherchel in Algeria, account of, 200.
Jura valleys, 47.
Jurassic rocks of Aveyron, iron ores found there, 18.

Kanawha, Great, its junction with the Ohio, 256; salt licks of, 257; its physical geography, 258; its tributary streams, 260; its population, 261; coal-fields of, 262.
Kef el Arez (near Tenez), limestone of, 229.
Kef-el-Hamam (near Tenez), remarkable copper lode there, 235.

Labour, cost of. *See* Cost of labour.
Lac de Joux in the Jura, 52.
Laissac, near Rodez, coal there, 17.
La Junquiera, a Spanish town near Perpignan, 87.
La Mancha, table-land of, 140.
Lake Halloula, near Algiers, 217.
Lake Superior copper, value of, at Pittsburg, 251.
Land, value of, near Pittsburg when sold with mineral rights, 253; in the Kanawha valley, 260; in the valley of Virginia, 281.
Languedoc, plains of, 31.
Lanjaron in the Alpujarras, account of, 152.
Lausanne, walk from that town through the Jura valleys, 47.
Lead, indications of, by the yellow phosphate, in the Aveyron, 21.
Lead ore in Aveyron, 23; in the Sierra de Gador, 159; in the island of Sardinia, 182; in Western Virginia, 274.
Lead mines of Aveyron, 22; of Linares, 141; of the Sierra de Gador, 159; of the island of Sardinia, 182.
Le Minier, a village on the Tarn (Aveyron), its mines, 22.
Lesser Atlas. *See* Atlas, Lesser.
Library, public, of Madrid, 120.
Lignite of Sardinia, 190.
Lime-kilns near Nantes, 5.
Limestone (for building purposes) near New York, 246.
Limestone plateau of Aveyron, 26.
Limestones of Ancenis, 5; jurassic, near Aubin, 18; of Roquefort, 29; of the Sierra de Gador, 159; of the

island of Sardinia, 182; of Algeria, 220, 229; of New York, 246; of the Appalachian chain, 276.
Limestones, hydraulic, of the Kanawha, 263; magnesian, of Sardinia, 182.
Linares, lead mines of, 141.
Lodes, nature of, in the Aveyron, 24; at Monte Poni (Sardinia), 183.
Lodestone in Madrid museum, 120.
Locle, village of (Jura), 55.
Loire, coal-field at Ancenis, on the, 3; character of its scenery near Ancenis, 6.
Lot, valley of the (Aveyron), 13, 20.
Luchon (Pyrenees), costumes at, 42.
Lujar, Sierra de, referred to, 148.
Lunel (Aveyron), iron ores of, 18.
Lynchburg (Eastern Virginia), position of, 281.

Madrid, account of, 117.
Magnesian limestones of Sardinia, 182.
Malaria in the island of Sardinia, 173.
Marble (used for building) of New York, 246.
Marçillac (Aveyron), cupriferous gravel at, 15.
Marine alluvium of the Metidja (Algeria), 219.
Marls (tertiary), mines of Tenez in, 232.
Mataró, railway thence to Barcelona, 94.
Medeah (Algeria), account of, 207, 220.
Meetings of Scientific Associations, their use, 47.
Megatherium, fossil, of Madrid, 121.
Meinberg (near Pyrmont), baths of, 77.
Merdja (Oued), (Algeria), mineral veins at, 224.
Metalliferous districts of Central France, 19; of the Sierra Nevada, 156; of the island of Sardinia, 182; of Algeria, 223.
Metamorphic rocks in crossing the Pyrenees, 88; near Gerona, 92; of Sardinia, 181; of the Sierra Nevada, 149; of Algeria, 219; of the Appalachian chain, 281.
Metamorphic shale near Cherchel, 227.
Metidja plain (Algeria, account of, 207, 216.
Milhau (Aveyron), mineral field near, 22.
Milianah (Algeria), account of, 206; mines near, 226.
Mineral resources of Central France, 10; of the Sierra de Gador, 159; of the island of Sardinia, 181; of Algeria, 223, 232; of the valley of the Kanawha, 257; of Eastern Virginia, 282.
Mineral waters of Pyrmont, 76, 80; of the Alleghany mountains, 279, 293.
Mineralogical collection at Madrid, 120.
Mines, School of, at Madrid, 120.
Mining, imperfect methods of, in Sardinia, 186; general remarks on, 189; in Algeria, general prospects of, 236.
Mining district of Central France, 19; of Sierra de Gador, 159; of Sardinia, 181; of Algeria, 224; of Eastern Virginia, 284.
Mint formerly established at Villefranche (Aveyron), 22.
Mississippi valley, Mr. Ellet's memoir on, referred to, 258.
Mondaluzac (Aveyron), calcareous iron ores of, 19.
Monoliths, ancient, of Sardinia, 178.
Monte Nebbida mines (Sardinia), 184.
Monte Poni, lead mine in Sardinia so called, 182.
Monte Vecchio mine (Sardinia), 188.
Mont Tendre, the Jura mountains near, 51.
Montpelier, account of, 37.
Monturban or Mont Terrible, structure of the rocks there, 61.
Moorish town of Tenez, 203.
Moorish women, their costumes, 195.
Moors, their careful irrigation, 99.
Mosques of Algiers, 195.
Mountains of Algeria, 213.
Moutier, valley of (Switzerland), 64.
Mouzäia (Djebel), a mountain range so called, 221; mines of, 224.
Muley Hassan, peak of, in the Sierra Nevada, 147.
Murillo, his pictures at Madrid, 122.
Museums of Madrid, natural-history, 120; picture gallery, 121.

Najac (Aveyron), mineral field near, 21.
Nantes, coal-field near, 3; scenery on entering, 9.
Narbonne, its salt lagoons and honey, 38.

Narbonne to Montpelier, nature of the country, 37.
Native population of Algiers, 195; native villages of Algeria, 208.
Navigation of the Ebro, obstructions to, 100; of the Ohio and Kanawha, 259.
Negro tribes in North America, their adaptation to the state they now exist in, 295.
Nemausus, city of (Nîsmes), 33.
Neocomian rocks near Mouzäia, 222.
New Canton (on James river), structure and succession of rocks there, 287.
New red sandstone, coal worked below this rock at Rodez, 17.
New River (Western Virginia), lead found there, 274.
New-Year's-day in New York, 248.
New York, journey to, and account of, 243.
Nîsmes, its amphitheatre, 32.
Nomenclature and spelling of names of places in Algeria, 200.
Nort, a pretty town near Nantes, 7.
Novi (Algeria), Roman antiquities near, 202.
Nur-hags or round-towers of Sardinia, 179.

Ohio valley, account of, 255.
Old Moorish town of Tenez, account of, 203.
Old workings of mines in the Aveyron district, 21; in Sardinia, 184.
Olot (Catalonia), extinct volcanos of, 93.
Oolitic rocks of Aveyron, iron mines of, 18; copper and lead mines of, 24.
Oolitic rocks of the Northern Jura, 60.
Orbe, valley of (Jura), 53.
Ores of copper and lead in Aveyron, 19.
Ores of copper in Sardinia, 170; in Algeria, 224.
Ores of iron used at Aubin, 18; in Algeria, 236; on the Kanawha, 273.
Ores of lead in the Aveyron, 23; in Spain, 159; in the island of Sardinia, 182; in Western Virginia, 274.
Orjiba in the Alpujarras, account of, 152.
Orleansville (Algeria), account of, 205.
Otter, Peaks of (Appalachian chain), 280.
Oued Allelah (Algeria), concession of, 233.
Oued Bou Aissi (Algeria), claim for concession at, 235.
Oued Kebir (Algeria), mines of, 225.
Oued Merdja (Algeria), mineral veins at, 224.

Paint Creek Company (Kanawha), their operations, 263; their progress, 272.
Palæozoic age of the Virginian gold, 292.
Palæozoic (middle) rocks of the Western Alleghanies, 277.
Pancormo, pass of Spain), 135.
Pass, fac-simile of an Arabic, 240.
Passports in entering Spain, 85, 89.
Passport system in Algeria, 237.
Pau, description of, 40.
Paving stones of New York, 246.
Pays de Causse (Aveyron), account of, 26.
Peña Golosa range of hills (Spain), 110.
Peniscola, position of, on the east coast of Spain, 109.
Pennsylvania, development of coal trade of, 269.
Pepinière or nursery garden at Algiers, 199.
Perda de s'Obiu, a lead mine in Sardinia, 185.
Perigord (Aveyron), iron ores of, 18.
Perpignan, account of, 39, 84.
Physical condition of the Metidja plain (Algeria), 219.
Physical geography of central France, 26; of the Jura valleys, 49; of the Eastern Pyrenees, 86; of the valley of the Ebro, 98; of the east coast of Spain, 106; of the valley of the Alpujarras, 145; of the island of Sardinia, 170; of Algeria, 212; of the Ohio and Kanawha valleys, 255; of the Alleghany mountains, 277.
Pic du Midi de Pau, account of, 41.
Pichiguet ores (Aveyron), results of analysis, 21.
Pictures of Valencia by Spanish masters, 112.
Picturesque scenery at Ancenis, 6; of the limestone plateau of France, 28; near Tenez, 231.
Pipes of lead ore at Monte Poni, 183.
Pisolitic iron ores of Veuzac (Aveyron), 18.
Pittsburg, road to, 250; account of its manufactures, 251.

Plain of Granada, 141.
Plains of Languedoc and Gascony, 31; of Sardinia, 172.
Plateau (limestone) of Central France, 26.
Plateau of Spain, 132.
Point Pleasant on the Ohio, at the mouth of the Kanawha, 256.
Pomeroys, coal seam and works at, 256.
Pont du Gard, an aqueduct near Nîsmes, 35.
Population, native, of Algiers, 195; of the Kanawha valley, 261; estimated to be supplied by the Kanawha coal-field, 267; of the slave States of America, 297.
Porphyries of Sardinia, 181.
Porphyritic axis of the Appalachians, 281.
Porrentruy, account of, 57; meeting of French Geological Society held there in 1838, 48.
Ports, principal, of Sardinia, 190.
Potter's clay in the Upper Kanawha, 273.
Price of coal at Nantes, 5; on the Ohio and Mississippi, 268.
Property, rights of, in slaves, 305.
Prospects of mining in Algeria, 236.
Provence, picturesque dresses of, 35.
Pruntrut or Porrentruy, account of, 57.
Public library of Madrid, 120.
Pyrenees, distant view of, 39, 42; view of, from Boulon, 86; structure of, 43.
Pyrmont, meeting at, 73.
Pyrmont waters, analysis of, 80.

Quality of coal in Brittany, 4; of Aubin coal, 15; of Rodez coal, 17; of Pittsburg coal, 253.
Quantity of coal estimated to exist in the Aubin concessions, 14; in Rodez concessions, 17; per acre in the Kanawha coal-field, 265; required on the Ohio and Mississippi, 269.
Quantity of water carried down by the Ebro, 102.
Quarries of limestone near Ancenis, their picturesque character, 6.
Quartu (near Cagliari), costumes of, 176.
Quartz (auriferous) of Eastern Virginia, 285.
Quartz, its character at Najac and Figeac, 21.

Railway communication and prospects in the south of France, 43; in Spain, 44.
Railway, Great Central of France, the mineral resources of the country through which it passes, 10; from Madrid to Aranjuez, 140; (projected) from Algiers to Blidah, 224; Central Virginian, 259.
Railways of New York, 247.
Rambla (in Spain), description of, 153.
Raphael, pictures by, in Madrid gallery, 126.
Ravine, picturesque, near Tenez, 230.
Results of slavery unsatisfactory, 303.
Reus, road to, from Tarragona, 105.
Rhône, delta of, 37.
Ribalta, his pictures at Valencia, 113.
River beds (dry) of the south of Spain, 103, 154.
River-courses in Algeria, 217.
River scenery of the Erdre, 8; of the Ebro, 102; of the Greenbrier, 277.
Roads of Spain, 87; of Sardinia, 173; excellence of, in Algeria, 216.
Road stuff of New York, 246.
Rocks, composition of, of the east coast of Sardinia, 170; near Algiers, 215.
Rock-salt in Algeria, 237.
Rodez coal-basin, account of, 15.
Rogers, Prof. W. B., notice of his report on the geology of Virginia, 280; his analysis of water of the White Sulphur springs, 293.
Roman antiquities of Nîsmes, 32; of Sardinia, 174, 180.
Roman mines in Sardinia, 184.
Romans, their management of the waters of the Ebro, 99.
Roquefort, account of the cheese so called, 29.
Round-towers (ancient) of Sardinia, 179.
Roussillon, plain of, 39.

Sahel of Algeria, account of, 212, 214; copper in the, 226.
Salines or Salt-licks of the Kanawha, account of, 257.
Salt-springs in Algeria, 237.
San Sebastian, account of, 136.

St. Afrique (Aveyron), mineral field near, 22.
St. Jean de Luz, costumes of, 137, 138.
St. Pierre, island of, in the Lac de Bienne, Switzerland, 68.
Sandstone, the prevailing rock of the lower carboniferous series of the Alleghanies, 262.
Sandstone accompanying coal at Pomeroys, 256.
Sandstone rocks of Externstein, 78.
Sandstones and limestones at Dakla (Algeria), 222.
Sardinia, island of, 167.
Sardinian government, neglect of the island of Sardinia by the, 173.
Scarabæus of jasper found in Sardinia, 180.
Scenery of the river Erdre, 9; of the limestone district of France, 28; of the great valley of Switzerland, 49; of Externstein near Pyrmont, 78; between Barcelona and Zaragoza, 97; of the Ebro, 102; of the country near Tarragona, 105; from the cathedral of Valencia, 115; of the country near Madrid, to the north, 133; of the Pyrenees near San Sebastian, 136; of the coast of Sardinia, 168; near Tenez, 231; of Greenbrier river (Virginia), 277; of the Appalachian chain, 280.
Scientific meetings of the French Geological Society at Porrentruy, 58; of the German Naturalists at Pyrmont, 73.
Schistose limestone near Blidah, 220.
Secondary rocks near Tenez, 229.
Sections across Aubin coal basin, 14, 15; Mondaluzac iron field, 19; Kanawha coal-basin, 264; the Appalachian chain, 282; Garnett and Mosely mining district, 289.
Severac, Rodez coal extends to, 16.
Sewell, Great and Little, mountain ranges so called, 276.
Shafts, coal, depth of, at Rodez, 17; unnecessary in working the Kanawha coal, 265.
Shales (metamorphic) near Algiers, 215; near Blidah, 220, 221.
Shaw, Mr. C., his report on the Covington and Ohio Railway, 259.
Sheep's-milk cheese of Roquefort, 30.
Sierras de Gador, Lujar, and Alhamilla, account of, 148.
Sierra Nevada, first view of, from the north, 141; account of, 145.
Silk Hall of Valencia, 112.
Slabs and slates at Ferrouka (Algeria), 220.
Slates and schists favourable for gold in Eastern Virginia, 291.
Slave labour, money value of, 301.
Slave population of the free States, gradual diminution of, 297.
Slavery as an economical question, 294.
Soil of the mineral district of Aveyron near Galés, 25; of the Sahel, near Algiers, 214; of the Metidja plains, 218; of Algeria, its true riches, 237.
Soleure (Switzerland), museum of, 66.
Somo-sierra (Spain), view from, 133.
Spanish cathedrals, 95, 104, 134.
Spanish character of the towns in the south of France, 39.
Splint coal of the Kanawha, 263.
Springs, artesian, in Algeria, 218.
Springs, mineral, of Pyrmont, 77; of 'White Sulphur' (Virginia), 279.
Steam-tugs suggested for the coal-trade of the Kanawha, 267.
Steamers on the Kanawha, Ohio and Mississippi, 267.
Stockton's cannel coal, 264; business of, 272.
Stockton's gold mine, 283.
Stones, building, used at New York, 246.
Streaming for lead ore without water, 159.
Street architecture of New York, 245.
Streets of Madrid, 119; of Algiers, account of, 198.
Structure, geological, of the mineral field of the Aveyron, 24; of the Jura, 60; of the Pyrenees at the eastern extremity, 88; of the country near Gerona, 92; of the country between Barcelona and Tarragona, 103; of the valleys of the Alpujarras, 146; of the south of Spain, near the Sierra Nevada, 150; of the country near Adra, 158; of Algeria, 219; (probable) of the Alleghanies, 278; of the auriferous district of Eastern Virginia, 286; of the Alleghanies, 292.

Sunset in the valley of Switzerland, 52.
Switzerland, travels in, 47.

Tarbes (Pyrenees), costumes at, 42.
Tarn river (Aveyron), mines near, 23.
Tarragona, account of, 104.
Tartana, account of the structure of this vehicle, 106.
Taska ou Roumi (coast of Algiers), structure of rocks near, 229.
Temperature of Algiers, 198; at Barcelona, 97; of the island of Sardinia, 172.
Temples, ancient, at Nîsmes, 35.
Tenez (Algeria), description of, 203.
Tenez, Cape, rocks of, 230.
Tenure of property in Virginia, 261.
Terrible, Mont. *See* Monturban.
Tertiaries near Gerona, 93.
Tertiary marls near Tenez, mines in, 232.
Tertiary rocks, mineral veins in, 223; of Algeria, 219; near Tenez, 229.
Teys, or sand islands, at the mouth of the Rhône, 38.
Thickness of coal in the Ancenis coal-field, 4; in the Aubin coal-field, 13; at Rodez, 16; in the Kanawha valley, 264.
Timber, cost of, in Algeria, 225.
Titian, pictures by, in the Madrid gallery, 126.
Titles of property, how secured in Virginia, 261.
Tortoli, Bay of (Sardinia), 169.
Tortosa (Spain), account of, 106.
Tour-magne at Nîsmes, account of, 31.
Town (Moorish) of Tenez, 203.
Towns on the Mississippi and its tributaries, 267.
Trees, common, in the Kanawha valley, 260.
Tributaries of the Kanawha, 260.
Tuomey, Mr., his report on South Carolina, 292.

Upheavals in the Sierra Nevada, 150; in the Metidja (Algeria), 220; of the Appalachian chain, 278.

Valencia to Madrid, road from, 116.
Valencia, account of the province, 109; costume of the people, 109; account of the city, 111.
Valley of the Erdre, 8; of the Ebro, 98, 106; of the Douro, 133; of the Cheliff, 219; of the Kanawha, 259.
"Valley of Virginia," the tract so called, 280.
Valleys of the Pyrenees, 87.
Valleys behind the Sierra Nevada, 145.
Vases, ancient Roman, from Sardinia, 167.
Vega or plain of Granada, 141.
Vegetation of north-eastern Spain, 92; of the south of Spain, 157; of the island of Sardinia, 172; of Algiers, 199; of the country near Tenez, 231.
Vehicles, public, of New York, 247.
Veins, mineral, near Tenez, 232; auriferous, of Eastern Virginia, 283.
Velasquez, his pictures and style, 122.
Verrières Suisses, Les, account of the villages so called, 55.
Vertical cuttings in soft rock in Spain, 147.
Vertical section of rocks near Tenez, 230.
Veuzac (Aveyron), pisolitic iron ores of, 18.
Villages, native, of Algeria, 208.
Villefranche (Aveyron), ancient importance of, 22; iron ores near, 18.
Virginia, valley of, the tract so called, 280.
Virginian Central railroad, selected line for, 259.
Virginian gold mines, account of, 283.
Volcanic district of France, as connected with the coal-fields, 11.
Vosges, fine outline of, from Switzerland, 59.

Waller gold mines (Eastern Virginia), account of, 283.
Washings for gold formerly carried on near James river, Virginia, 283.
Watch-making in the Jura, 56.
Water, action of, near Tenez, 230; in the Kanawha valley, 261.
Water, great value of, in Spain, 100.
Water facilities of Aveyron, 20.
Water power of island of Sardinia, 190.
Water supply in Algeria, 218.
Waters, mineral, of Pyrmont, 76, 80; of White Sulphur springs, Virginia, 293.

Watershed and drainage of the coal-fields of Central France, 11.
Watershed in the Sierra Nevada, 149; of the country near Algiers, 220.
Water-worn rocks of Externstein, 78.
Weissenstein, view from, 66.
White Sulphur springs, account of, 279; analysis of water of, 293.
Willis's mountain, Virginia, notice of, 289.
Wines of Valencia and the east coast of Spain, 110.
Women, Moorish and Jewish, their costumes in Algiers, 195.
Wood obtainable in Sardinia for mines, 189.

Zaccar peaks (Algeria), account of, 206.
Zaragoza, notice of, 98.
Zoological garden suggested at Algiers, 199.

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